AVIATION WEEK

A McGRAW-HILL PUBLICATION

August 27, 1956 50 cents

Air Show Attracts Top Planes of Industry, Services

North American F-100Cs

Light Turboprops Stimulate STOL/VTOL

Just between us...

Even a child's whispered secret can be heard in Convair's new METROPOLITAN 440—the quietest passenger cabin of any airliner flying today!

New noise suppression techniques developed by Convair and leading acoustics consultants have given the Metropolitan 440 the quietest passenger cabin of any airliner flying today! In addition, the new Metropolitan 440 offers you more luxury! More speed! And all of the qualities of passenger comfort and dependability that have made the Convair first choice throughout the world.

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION

Now Flying: SAS, Denmark, Norway, Sweden; SWISSAIR, Switzerland; SABENA, Belgium; AERO O/Y, Finland; CONTINENTAL, U.S.A.; DELTA, U.S.A.; NATIONAL, U.S.A.; REAL S.A., Brazil · ***Soon to Fly:*** ALITALIA, Italy; ANSETT, Australia; BRANIFF, U.S.A.; EASTERN, U.S.A.; IBERIA, Spain; JAT, Jugoslavia; LUFTHANSA, Germany; NIPPERI, Japan

You can't stump this expert!

The Fairchild C-123 Tech Rep—engineer, trouble shooter, production expert and top flight maintenance man—watches over the career of every Fairchild airplane assigned to the U. S. Air Force.

His job is to help keep the C-123 flying in top operating condition all the time... he squeezes extra flying hours out of every week. He has to be able to anticipate problems, answer any questions about powerplants, propellers, landing gear, electrical systems and dozens of other C-123 components—and be able to repair or maintain any of them. He's thoroughly experienced in how the plane was built, how it should fly... and how to *keep it flying*. He works hand in hand with Air Force flight engineers, crew chiefs and maintenance men.

He's the Fairchild C-123 maintenance and flight expert... his presence at bases all over the world gives the United States Air Force the greatest possible utility from Fairchild-built aircraft in squadron service.

FAIRCHILD

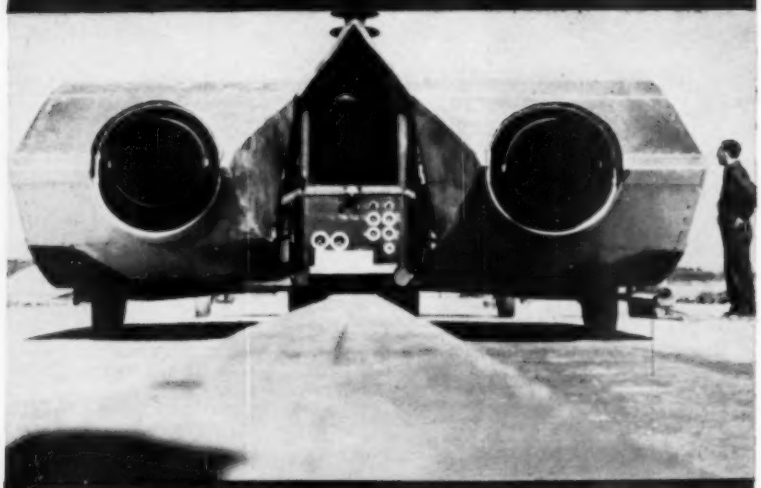
AIRCRAFT DIVISION • HAGERSTOWN 10, MARYLAND

A Division of Fairchild Engine and Airplane Corporation

...WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!

proving ground for ideas needs

Creative Engineers

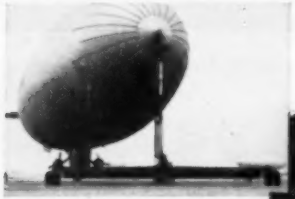


Jet powered test car generates 10,000 lbs. of thrust . . . used by AAE engineers in development of aircraft arresting gear.

A proving ground for ideas is the most apt description for All American Engineering. For over 16 years, AAE has specialized in engineering service to the aviation industry and the military . . . working at the critical stage between design concept and prototype.

PROVING OUT AT ALL AMERICAN

A totally new concept in energy absorption, the "water squeezer."



AAE advanced type portable mooring mast greatly extends range of the Navy's airships.

Daring advance concepts — like the flying submarine and airplane-launched landing craft — have most recently stemmed from AAE drawing boards. At the same time, All American has designed and produced universal landing gear, airborne winches, seat ejection trainers, and a wide range of energy absorption devices.

Engineers, investigate your career at AAE today.

All American Engineering Company

DUPONT AIRPORT • WILMINGTON, DELAWARE

AVIATION CALENDAR

Sept. 1-3—1956 National Aircraft Show, Will Rogers Field, Oklahoma City.

Sept. 3-7—Canadian National Air Show, Toronto, Canada.

Sept. 3-9—Society of British Aircraft Constructors' 17th Annual Air Show, Royal Aircraft Establishment, Farnborough, Hampshire, England.

Sept. 5-7—Symposium on Atmospheric Optics, sponsored by Physical Research Labs., Boston Univ., Sargent Camp, Peterborough, N. H.

Sept. 6—Seventh annual Engine Operation & Maintenance Forum, sponsored by Airwork Corp., Pratt & Whitney Aircraft, at Airwork Corp. and Millville Airport, Millville, N. J.

Sept. 8—First annual National Convention of the OX5 Club, Williamsport, Pa. Contact: Clifford Ball, Secy., OX5 Club, 214 Plaza Bldg., Pittsburgh, Pa.

Sept. 9-11—International Northwest Aviation Council, 20th annual convention, Boise, Idaho.

Sept. 10—Pratt & Whitney, Southwest Airmotive Co. Engine Forum, Melrose Hotel, Dallas.

Sept. 10-14—American Society of Mechanical Engineers, Instruments & Regulators Div. Meeting, Detroit, Mich.

Sept. 14-15—Conference on Communications, Roosevelt Hotel, Cedar Rapids.

Sept. 17-21—American Society for Testing Materials, Second Pacific National Meeting and Apparatus Exhibit, Hotel Statler, Los Angeles.

Sept. 17—International Air Transport Association, 12th annual general meeting, Edinburgh, Scotland.

Sept. 17-21—Eleventh Annual Instrument-Automation Conference & Exhibit, sponsored by the Instrument Society of America, Coliseum, New York, N. Y.

Sept. 17-22—International Congress of Astronautics, sponsored by the International Astronautic Federation, Rome, Italy.

Sept. 18-20—Twenty-fourth USAF-Aircraft Industry Flying Safety Conference, sponsored by USAF Flight Safety Research, Santa Barbara, Calif.

Sept. 24-26—American Rocket Society, fall meeting, Hotel Statler, Buffalo, N. Y.

Sept. 24-28—1956 Trade Fair of the Atomic Industry, Navy Pier, Chicago.

AVIATION WEEK • AUGUST 27, 1956
Vol. 65, No. 9

Published weekly with an additional issue in December by the McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. Executive, Editorial, Advertising and Subscription offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Offices: 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph T. Allen, Vice President and Director of Advertising Sales; J. E. Blackburn, Jr., Vice President and Circulation Director.

Subscription: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 West 42nd St., New York 36, N. Y. Allow 10 days for change of address.

Subscriptions are solicited only from persons who have a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.

Single Copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par. Other Western Hemisphere and the Philippines $10 a year; $16 for two years; $20 for three years. All other countries $20 a year; $30 for two years; $40 for three years. Second class mail privileges authorized at Albany 1, N. Y. Printed in U. S. A. Copyright 1956 by McGraw-Hill Publishing Co. Inc. All Rights Reserved. Cable Address: "McGraw-Hill New York." Publications combined with AVIATION WEEK are AVIATION, AVIATION NEWS, AIR TRANSPORT, AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL. All rights to these names are reserved by McGraw-Hill Publishing Co.

Phillips 66
PRESENTS
MILESTONES IN AVIATION

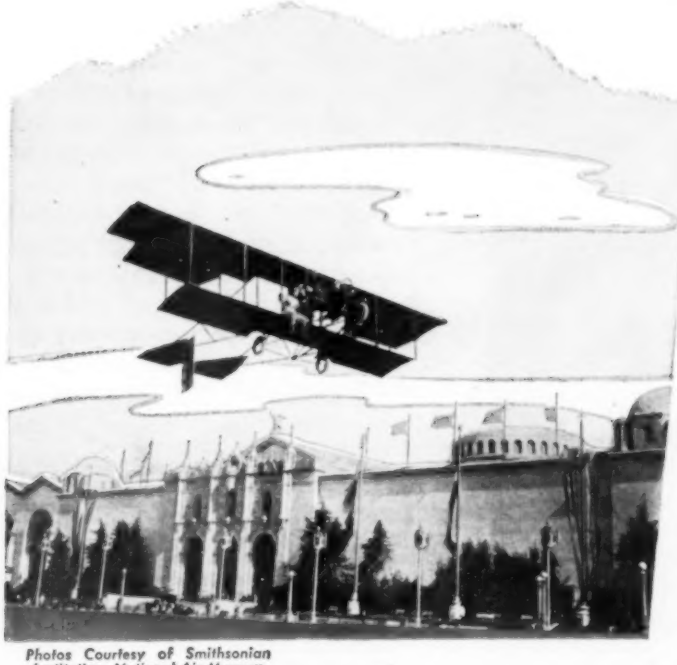
Bird Boy Art Smith

Whenever daring exploits of pioneer aviators are chronicled, the name of Bird Boy Art Smith is sure to appear. From the time he flew his first Curtiss-type biplane in 1911 until his death in 1926, Art Smith dedicated his life to aviation.

The romance of his life was heightened by the unselfish encouragement of his mother and father, who mortgaged their home so that their son could have the money to build his first airplane. Another inspiration of his early years was his sweetheart, Aimee Cour. They eloped in 1912 in what is considered to be the world's first airplane elopement.

Flying in such places as Deadwood, S. Dakota, and in the capital of Japan, Art Smith set the world record for looping the loop, pioneered sky writing and invented dozens of breath-taking stunts to win acclaim of millions throughout the world.

The custom of showing admiration for Art Smith's flying by giving him a medal started with a flight he made in the Black Hills in 1912. One of his most prized awards was a gold nugget, given him by his hero, Buffalo Bill.



Photos Courtesy of Smithsonian Institution, National Air Museum

Phillips 66
AVIATION PRODUCTS

It's Performance that Counts!

A pioneer in research and manufacturing to meet aviation needs, Phillips Petroleum Company continues its leadership as a supplier of high octane gasoline and new *super performance* Jet Fuels for today's aircraft.

Since aviation's early days, Phillips has taken an active part in setting up higher standards for aviation fuel. In fact, Phillips pioneered in producing such important Avgas components as HF Alkylate and Di-isopropyl.

In aircraft fuels, it's performance that counts. And military and commercial operators know they get *super* performance from Phillips 66 products.

AVIATION DIVISION
PHILLIPS PETROLEUM COMPANY
BARTLESVILLE, OKLAHOMA

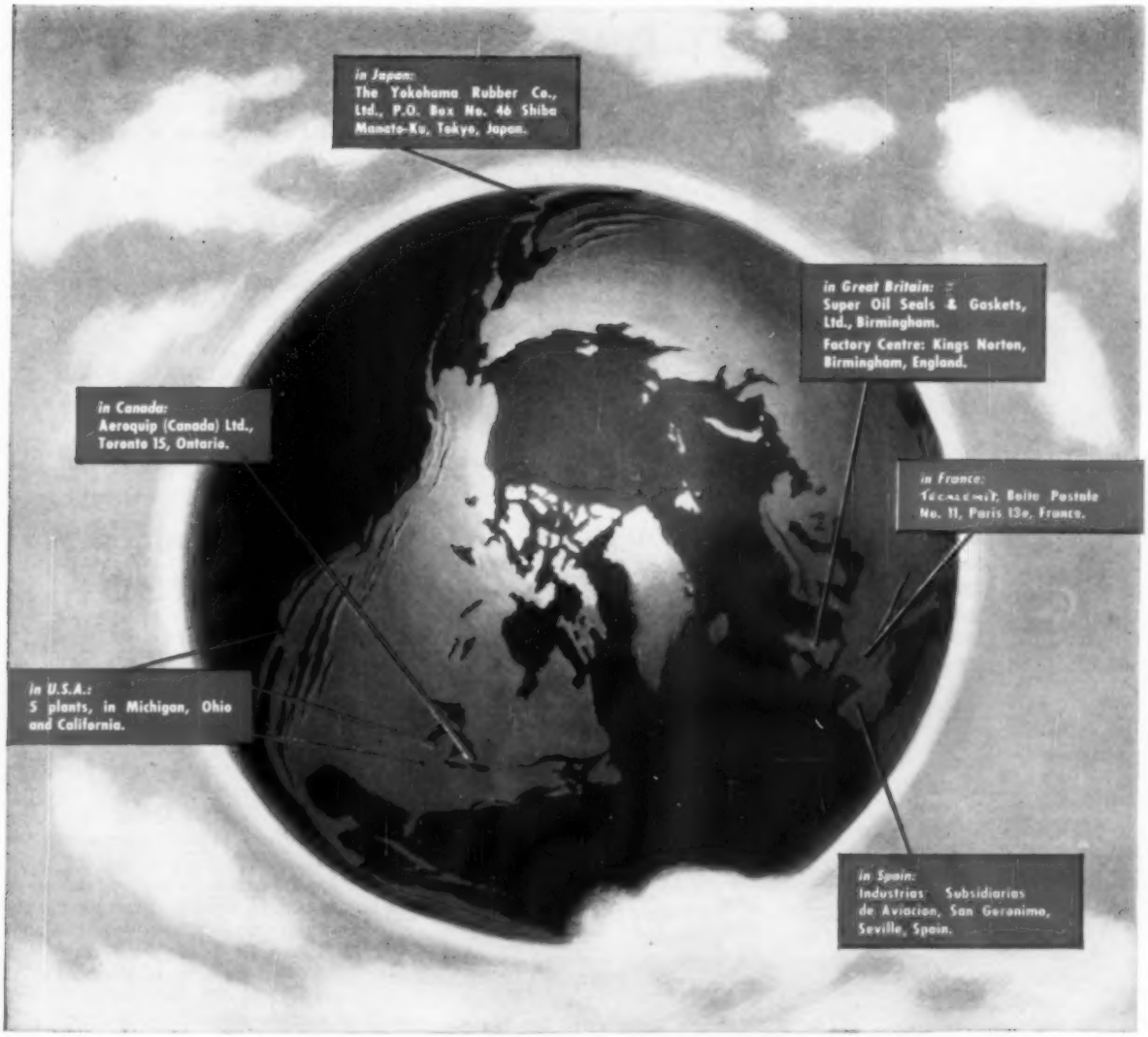
the dawn . . . of stainless steel honeycomb!

After five years of pilot production and research, HEXCEL Products Inc. has now perfected a high speed production line for the manufacture of low cost stainless steel honeycomb core material – a development which opens a new horizon for sandwich construction in the aircraft industry. Capable of greater strength than either glass fabric or aluminum honeycomb – two materials which produced the highest strength-to-weight combination ever developed – stainless steel core will provide a degree of rigidity never before achieved in sandwich structures. The new material, which has excellent strength properties at temperatures of up to 1000°F., means low cost and high efficiency construction for many primary aircraft parts. It also makes practical the manufacture of high speed aircraft previously "board-bound" by the thermal barrier.

If you think stainless steel honeycomb could solve an aeronautical design problem of yours, write for further information to HEXCEL Products Inc., 951 61st Street, Oakland 8, California.

HEXCEL®
PRODUCTS INC.

America's leading producers
of honeycomb core materials


in Japan:
The Yokohama Rubber Co., Ltd., P.O. Box No. 46 Shiba Mamato-Ku, Tokyo, Japan.
in Great Britain:
Super Oil Seals & Gaskets, Ltd., Birmingham.
Factory Centre: Kings Norton, Birmingham, England.
in Canada:
Aeroquip (Canada) Ltd., Toronto 15, Ontario.
in France:
Tecnecma, Boite Postale No. 11, Paris 13e, France.
in U.S.A.:
5 plants, in Michigan, Ohio and California.
in Spain:
Industrias Subsidiarias de Aviacion, San Geronimo, Seville, Spain.

All Over the World

Aeroquip Products Are Made With One Standard of Quality

The accent may vary with the country, but there is only one "Aeroquip" name, and it conveys the same meaning to all who know it.

Aeroquip stands for *Flexible Hose and Reusable Fittings of uniformly high quality and dependable performance!*

For regardless of where Aeroquip Products are made —in England, France, Spain, Japan, Canada, or the United States—they always conform to precise Aeroquip specifications.

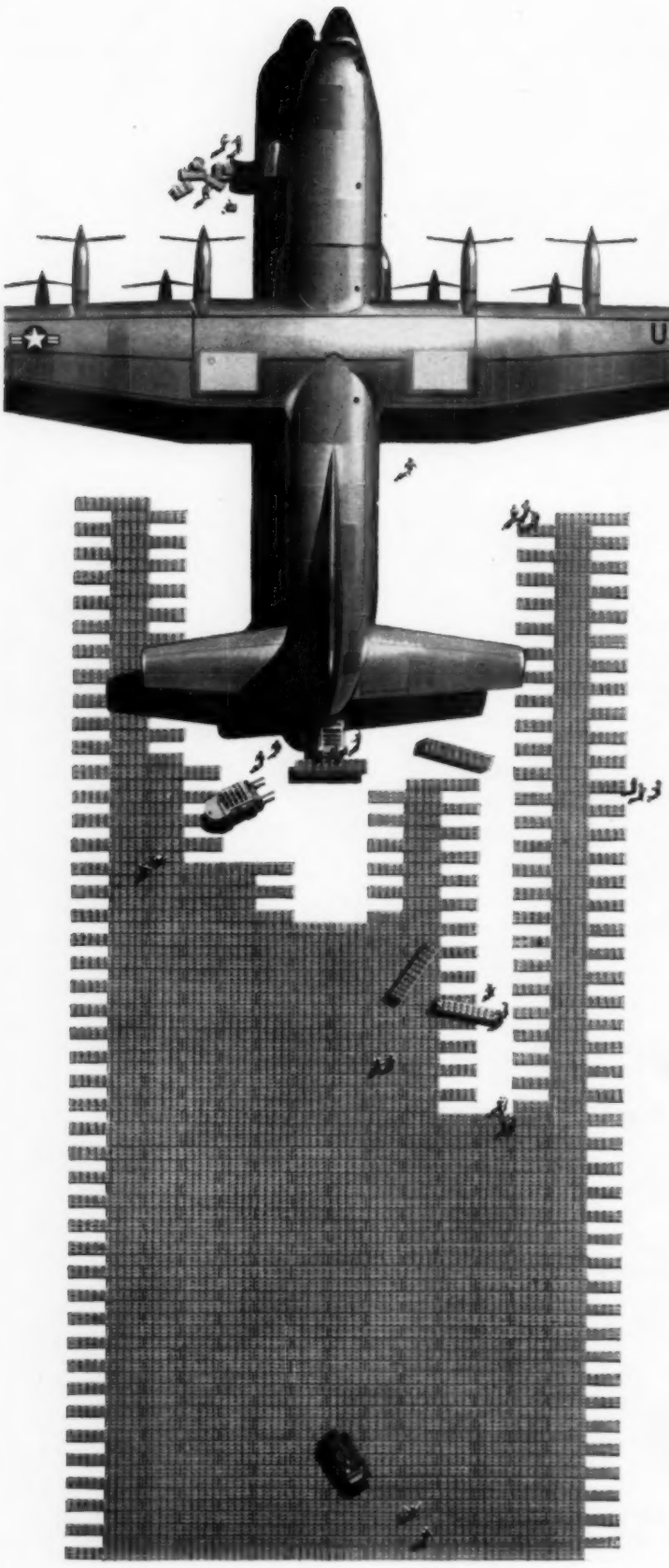
Adequate factory sales staffs supported by extensive distributor organizations assure prompt service for aircraft and industrial manufacturers and users in practically every important industrial country throughout the free world.

Aeroquip

REG. TRADEMARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN, U.S.A.

LOCAL REPRESENTATIVES IN PRINCIPAL CITIES IN U.S.A. AND ABROAD • AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD



SPECIFICATIONS:
Speed, 357 mph; range, 2,500 nautical miles; payload, 25,800 pounds; takeoff distance, 2,000 feet; landing distance, 1,320 feet. Fully pressurized. Powered by 4 Allison propjets.

LOCKHEED HERCULES

USAF C-130

CAN CARRY AN AIRSTRIP WHEREVER HE GOES

Airhead? Needed fast? Call in 18th Air Force's (Tactical Air Command) new C-130 Hercules, built by Lockheed for cargo and personnel, endowed with 20-ton lift-capacity and jet-age speed.

Hercules works fast: The paratroopers he dropped have the area under control. Century series fighters, like Lockheed's F-104, have control of the air situation. Next job is to bring in the engineers together with their material and machines to build the strip. As it takes shape, the propjet giant shuttles between base and advanced strip, maintaining flexible supply lines—handling orders for more material quickly and efficiently.

Before long the strip is humming. Fighters roar in and out. Repair, communications, logistics... all the myriad military operations are in high gear.

Hercules' job is just beginning. The medics want fast transport back to base hospital for the injured. Paratroopers are dropped to take a key hill. Food, ammunition, heavy weapons are ready to be dropped in widely-scattered areas.

There's little rest for this "strongman" of the USAF: That's OK... he doesn't need much.

NOW IN QUANTITY PRODUCTION AT **USAF PLANT NO. 6.**

LOCKHEED
AIRCRAFT CORPORATION
Georgia Division, Marietta, Georgia

Look to Lockheed for Leadership

Cessna T-37 designed for Jet Training

To meet jet age demands, the U. S. Air Force requires a jet trainer that makes it easy for cadet-pilots to master first line combat airplanes.

The Cessna developed T-37 introduces the cadet to all combat jet airplane characteristics while training on this safe, easy-to-fly jet trainer.

It is designed to provide the Air Force with a jet trainer that can be operated at substantial savings and cover the most important and longest phase of the cadet-pilot's jet training.

It is a privilege for us here at Cessna to team with the Air Force in its forward-thinking plans for the jet age. CESSNA AIRCRAFT COMPANY, Wichita, Kans.

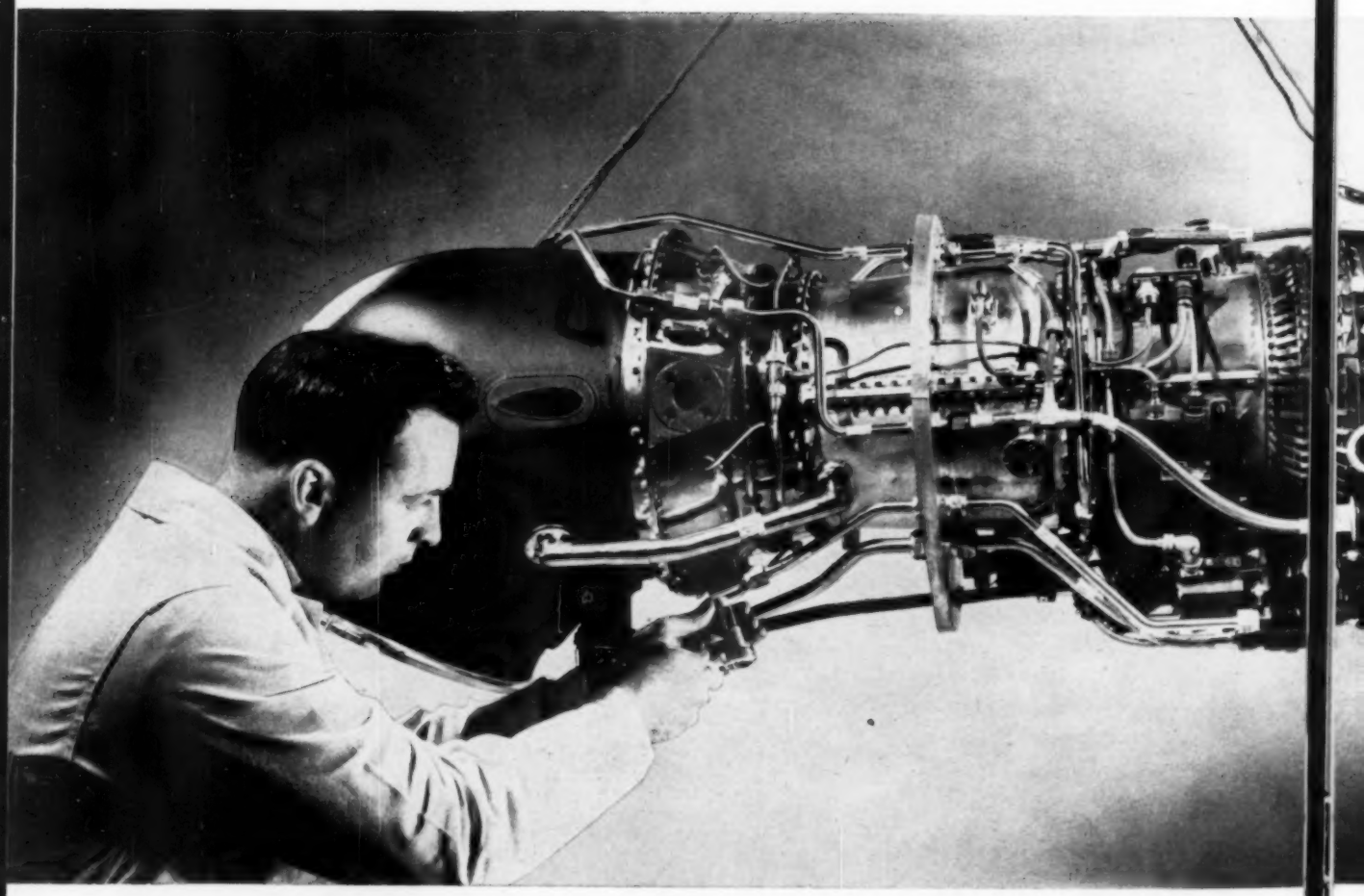
Cessna®

For Air Force cadet-pilots, a safe, easy step into first line jets.

Be an Aviation Cadet. Inquire today about the future your Air Force offers from your Air Force Recruiting Office.

General Electric's New

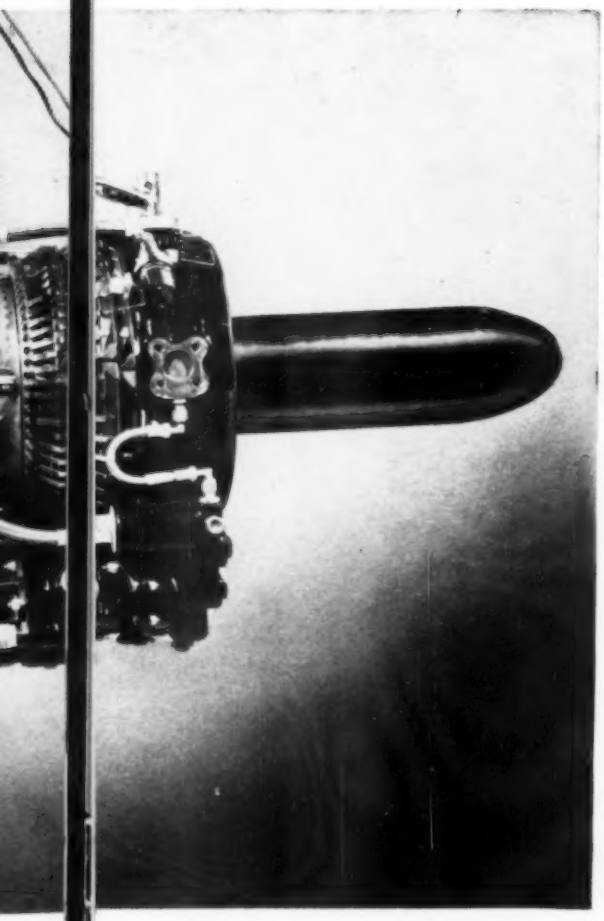
WEIGHS 250 LBS



THE T58 is a high-performance, axial-flow gas turbine engine. In helicopters, the T58's new constant-speed engine control and free power turbine will greatly simplify pilot duty and permit operation of the helicopter's rotor at its maximum efficiency.

T58 Turboshaft Engine

DELIVERS 1050 HP



specific fuel consumption — 0.67 normal
specific engine weight — 0.24 lb/hp
overall engine length — 55 inches
diameter at maximum flange — 16 inches

General Electric's T58 turboshaft engine is "power in a small package." Power for helicopters, convertiplanes, and tomorrow's small aircraft.

With a power-weight ratio of more than four to one—fuel consumption rivalling a reciprocating engine's—the T58 introduces an era of outstanding small aircraft performance and operating economy.

New standards of speed, range, and payload will follow the T58 wherever it flies. Easy maintenance, long operating life, installation flexibility—these, too, are inherent by-products of the T58's advanced design.

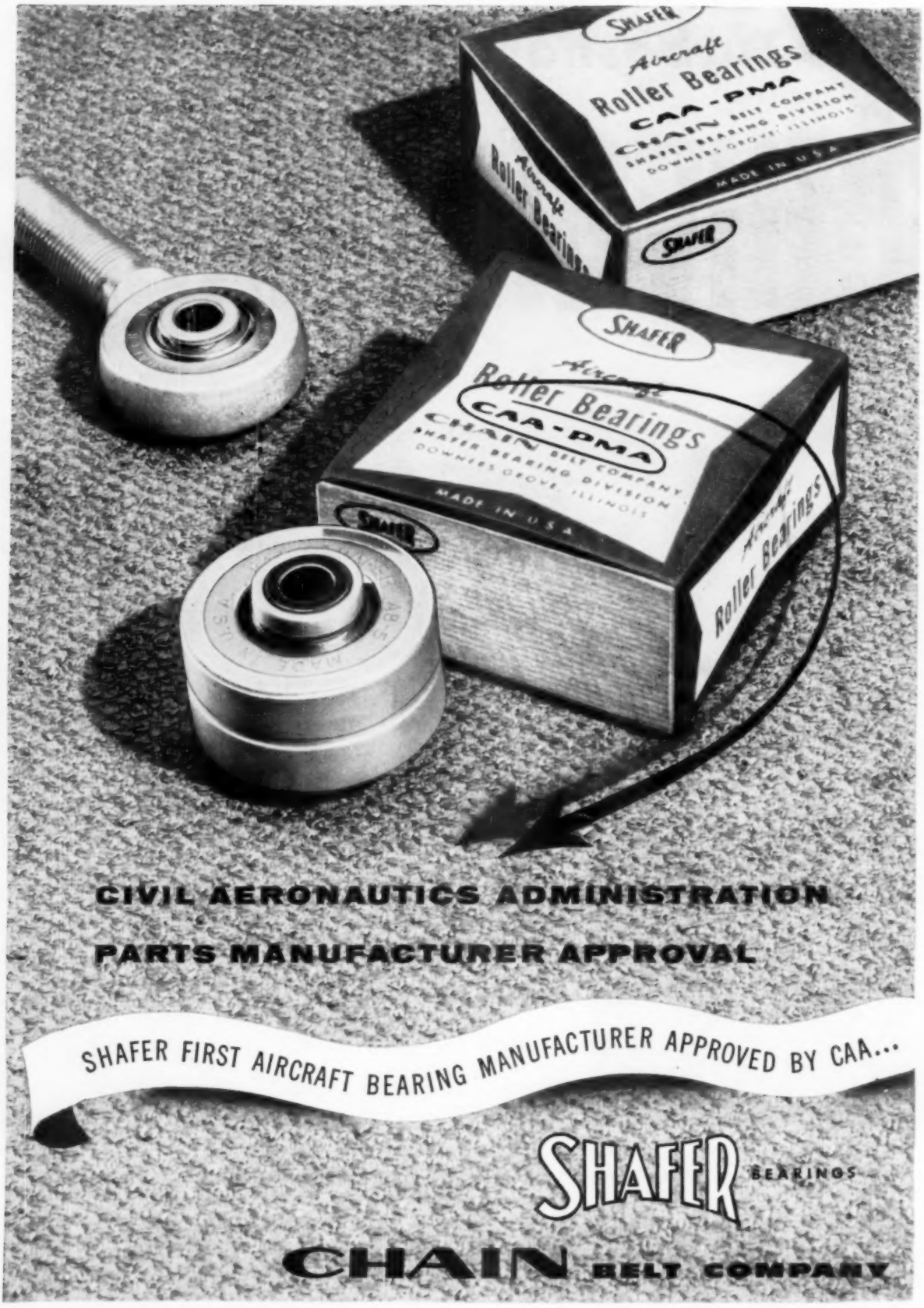
The T58 was designed and developed for the U.S. Navy by General Electric's Small Aircraft Engine Department in Lynn, Mass. It is further evidence of G.E.'s skill and experience in the art of aircraft gas turbine design.

Find out what the T58's many features can mean to your aircraft. Call your General Electric Aviation & Defense Industries Sales Office or write: General Electric Company, Section 233-2, Schenectady, N. Y., for the T58 descriptive bulletin.

All figures are based on engine without helicopter reduction gear. Gear weight: 75 lbs.

Progress Is Our Most Important Product

GENERAL ELECTRIC


SHAFER
Aircraft
Roller Bearings
CAA-PMA
CHAIN BELT COMPANY
SHAFER BEARING DIVISION
DOWNERS GROVE, ILLINOIS
MADE IN U.S.A.
CIVIL AERONAUTICS ADMINISTRATION
PARTS MANUFACTURER APPROVAL
SHAFER FIRST AIRCRAFT BEARING MANUFACTURER APPROVED BY CAA...
SHAFER BEARINGS
CHAIN BELT COMPANY

Each spot represents an application of MICROJet® pressure ratio controls

VERSATILE MICROJET CONTROLS find many uses on modern high speed aircraft and missiles, regulating a variety of engine functions. Custom-designed Microjet control systems sense and reduce parameters to pneumatic signals, and compute schedules for inlet ramp position, inlet guide vane angle, fuel flow, afterburner ignition or jet nozzle area. Their simple, rugged construction—insensitive to environmental extremes—has been proven on high-performance engines by leading manufacturers. For further information on Microjet controls, address Solar Aircraft Company, Dept. C-64, San Diego 12, California.

SOLAR
AIRCRAFT COMPANY
SAN DIEGO DES MOINES

ENGINEERS WANTED *Unlimited opportunities in Solar's expanding gas turbine program! Write today, giving experience.*

WORLD'S FASTEST FIGHTER LANDS ON

COMPACT CPT LIQUID SPRING

Hardest-working component of the Lockheed F-104 landing gear is its compact liquid spring, engineered and built by Cleveland Pneumatic.

CPT Liquid Springs provide high load absorption within the minimum space available on this razor-wing aircraft. Over 70,000 test cycles proved the reliability of the liquid spring principle.

Whether your aircraft designs permit use of conventional AEROL* shock-absorbing struts or whether razor-thin wings create space problems, CPT will design and build landing gear to handle the job dependably. We've been solving landing-gear problems for over 30 years. Our modern 350,000-square-foot plant is equipped to produce CPT AEROLS or Liquid Springs to fit your production schedule.

*T.M.

BE A CPT ENGINEER!

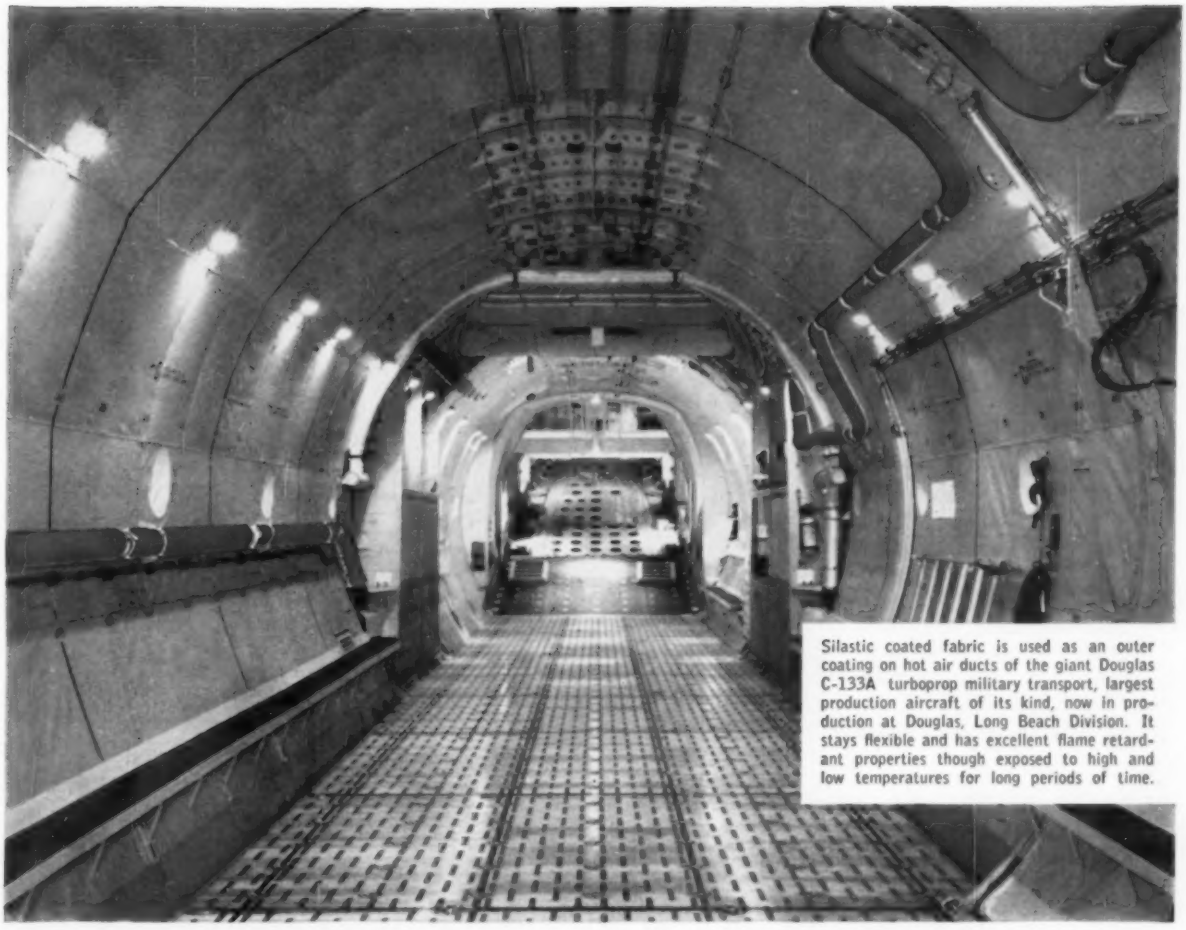
Liberal pension and profit-sharing plans, interesting work, plenty of advancement opportunity. Tell us your qualifications today.

CPT

CLEVELAND PNEUMATIC TOOL COMPANY

3781 East 77th Street • Cleveland 5, Ohio

Sales-engineering offices in Seattle, Los Angeles, Fort Worth-Dallas and Levittown, L.I.



Silastic coated fabric is used as an outer coating on hot air ducts of the giant Douglas C-133A turboprop military transport, largest production aircraft of its kind, now in production at Douglas, Long Beach Division. It stays flexible and has excellent flame retardant properties though exposed to high and low temperatures for long periods of time.

SILASTIC coated fabrics seal in heat

SILICONE RUBBER

Fabrics coated with Silastic*, Dow Corning's silicone rubber, are used for ducting, control surface seals, gaskets, and electrical insulating tapes. They give superior resistance to heat, moisture, ozone, certain hot oils and chemicals. Available through leading rubber companies in many combinations of different cloths and compounds to provide the specific properties desired.

Get latest data on Silastic

Mail coupon today

Dow Corning Corporation, Dept. 0908b
Midland, Michigan

Please send me latest data on Silastic

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Typical Properties of Silastic Coated Fabrics

• Temperature range, °F	—130 to 500
• Weather, ozone and corona resistance	Excellent
• Abrasion resistance	Fair to Good
• Fungus resistance	Excellent
• Dielectric strength, volts/mil	800 to 1200

Flame resistant coated glass fabrics are obtainable by using selected Silastic stocks.

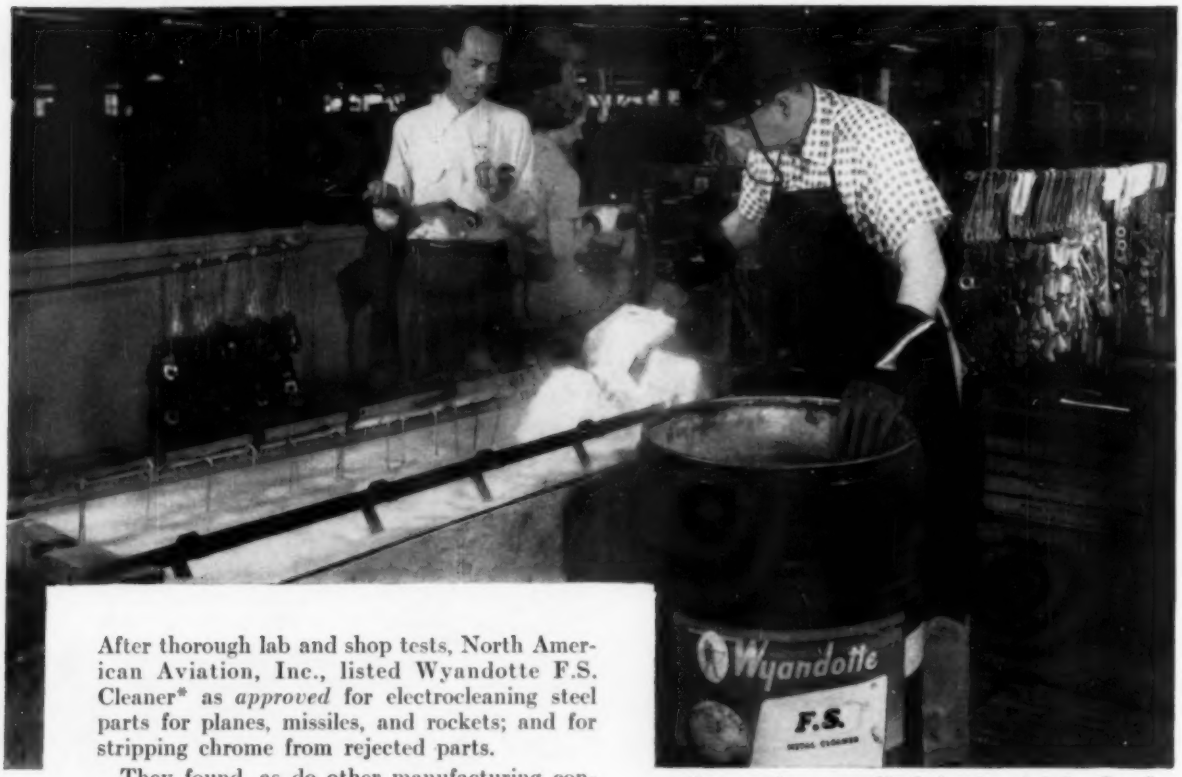
*T M REG U S PAT OFF.

If you consider ALL the properties of a silicone rubber, you'll specify SILASTIC.

first in silicones — DOW CORNING SILICONES

DOW CORNING CORPORATION • MIDLAND, MICHIGAN

North American lists Wyandotte F.S. as "approved" for electrocleaning steel



For over three years, North American Aviation, Inc., has used Wyandotte F.S. in their main plant in Inglewood, California, on all steel parts requiring cleaning.

After thorough lab and shop tests, North American Aviation, Inc., listed Wyandotte F.S. Cleaner* as *approved* for electrocleaning steel parts for planes, missiles, and rockets; and for stripping chrome from rejected parts.

They found, as do other manufacturing concerns, that F.S. gives them product economy, long solution life, and outstanding cleaning ability.

Wyandotte F.S. Cleaner is noted for its exceptional detergency in removing smut, fabricating oils, and compounds. It features fast, complete wetting action, controlled foaming, and very free rinsing. In addition, it has high soil suspension ability, and is 100% soluble in water. Wyandotte F.S. may be the very electrocleaner you have been seeking for your metal-cleaning operations.

Let the Wyandotte representative demonstrate his complete line of products for the aviation industry to you! Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.

*Reg. U. S. Pat. Off.

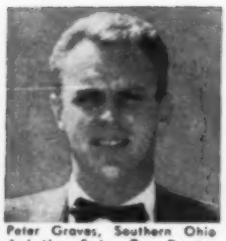
Wyandotte CHEMICALS

J. B. FORD DIVISION

SPECIALISTS IN AIRCRAFT-CLEANING PRODUCTS

Don Vest, Vest Aircraft & Finance Co., P. O. Box 5306, Sky Ranch Airport, Denver, Colorado.

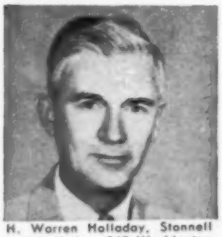
Gene Hudman, Stonnell and Holladay Aircraft Sales, Carolina Division, Municipal Airport, Charlotte, North Carolina.



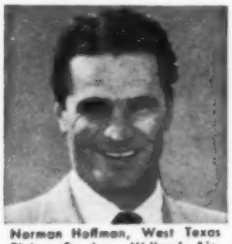
Peter Graves, Southern Ohio Aviation Sales Co., Dayton Municipal Airport, Vandalia, Ohio.

John Wilsdon, Hunter Aviation Co., P. O. Box 122, Lambert Field, St. Louis, Missouri.

Victor "Vic" Bruce, Indianapolis Executive Aircraft Corp., Indianapolis Municipal Airport, Indianapolis, Indiana.



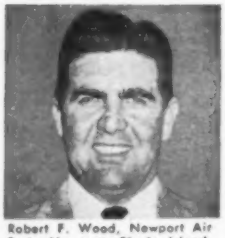
H. Warren Holladay, Stonnell and Holladay, 843 Washington Building, Arlington Towers, Arlington, Virginia



Norman Hoffman, West Texas Flying Service, Midland Airport, Box 82, Midland, Texas.

Art Maurer, Arthur Maurer Co., Inc., LaGuardia Field, New York, N. Y.

John S. Brown, Brown Aero Corp., 3300 Love Field Drive, Dallas, Texas.



Robert F. Wood, Newport Air Park, Newport, Rhode Island.

Wynn Cronje, Minnesota Airmotive, Inc., Minneapolis-St Paul International Airport Minneapolis Minnesota.

A. M. "Sima" Bertolet, Reading Aviation Service, Inc., Municipal Airport, Reading, Pennsylvania.

Max R. Brand, Aero Commander Dist. (Downtown Airpark), Hangar 3, Municipal Airport, Tulsa, Oklahoma.

E. H. "Ted" Tolan, National Aero Sales Corp., Midway Airport, Chicago, Illinois.

W. D. Maddox, Aero Southern Corp., 601 North Broadway, Nashville, Tennessee.

W. H. "Bill" Buchanan, Sales Manager, Johnson Air Interests, Inc., Horlick-Racine Airport, Racine, Wisconsin.

Louis Humphreville, Executive Aircraft Corporation, Municipal Airport, Pontiac, Michigan.

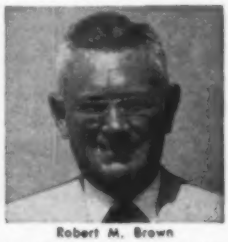
W. B. Carrell, Chamberlain Aviation, Inc., Akron Municipal Airport, Akron, Ohio.

John A. "Jack" Bauman, Santa Monica Aviation, 3011 Airport Avenue, Municipal Airport, Santa Monica, California.

Herrol Bellamy, L. B. Smith Aircraft Corp., Miami International Airport, Miami, Florida.

Lucien M. Taillac, Trans-Aire Corporation, Pan-Air Building, New Orleans Airport, New Orleans, Louisiana

Joseph H. Frost, Jr.



Robert M. Brown

Commander Sales Company, Terminal Building, International Airport, San Antonio, Texas.

NATION-WIDE SALES and SERVICE

AERO DESIGN Commander

AERO DESIGN AND ENGINEERING COMPANY

TULAKES AIRPORT • OKLAHOMA CITY, OKLAHOMA

Everywhere you look, "miniaturization" has meant progress and profit. The automobile is packed with many more features, much more power, all in the same space through miniaturization.
Big profits are coming in smaller packages!
This book tells how Elgin's "Practical Miniaturization" can help you! Write for it today!
Today's telephone depends on more dependable, "miniaturized" assemblies. Better performance, reduced costs—these are the keynotes of "Practical Miniaturization".
Progress and Profit through Miniaturization
how ELGIN'S "practical miniaturization" can help you
ELGIN NATIONAL WATCH COMPANY
MICRONICS DIVISION • ELGIN, ILLINOIS

AUGUST 27, 1956

AVIATION WEEK

VOL. 65 NO. 9

Editorial Offices

New York 36—330 W. 42nd St., Phone: LOngacre 4-3000 (Night LO 4-3035)
Washington 4, D. C.—National Press Bldg., Phone: NAtional 8-3414, REpublic 7-6630
Los Angeles 17—1125 West Sixth St., Phone MAdison 6-9351

PUBLISHER.....Robert W. Martin, Jr.
EDITOR.....Robert B. Hotz

MANAGING EDITOR.....Alpheus W. Jessup
ASST. MANAGING EDITOR (TECHNICAL)
David A. Anderton
WASHINGTON.....Cecil Brownlow
NEW YORK.William Gregory, James J. Dailey
LOS ANGELES.Irving Stone, Richard Sweeney
ENGINEERING.....Robert H. Cushman, Russell Hawkes
AVIONICS.....Philip J. Klass
CONGRESS.....Katherine Johnsen
MILITARY.....Claude O. Witze, Evert Clark
TRANSPORT....Craig Lewis, Glenn Garrison, L. L. Doty
EQUIPMENT.....G. L. Christian
BUSINESS FLYING.....Erwin J. Bulban
ART EDITOR.....Lawrence J. Herb
ASST. ART EDITOR.....Robert G. Young
EDITORIAL PRODUCTION...Jerome E. Kelley
EDITORIAL ASSISTANTS
Bernie Lang, Betty Hein
LIBRARIAN.....Jeanne Rabstejnek

FOREIGN NEWS SERVICE

EDITOR.....John Wilhelm
LONDON.....William J. Coughlin
PARIS.....Robert E. Farrell
BONN.....Gerald W. Schroder
MEXICO CITY.....John H. Kearny
RIO DE JANEIRO.....Peter Weaver
TOKYO.....Dan Kurzman

DOMESTIC NEWS BUREAUS

ATLANTA 3.....801 Rhodes-Haverty Bldg.
CHICAGO 11.....520 N. Michigan Ave.
CLEVELAND 15.....1510 Hanna Bldg.
DETROIT 26.....856 Penobscot Bldg.
HOUSTON 25.....1303 Prudential Bldg.
LOS ANGELES 17.....1125 West Sixth St.
SAN FRANCISCO 4.....68 Post St.
WASHINGTON 4...1189 National Press Bldg.

SALES

ADVERTISING SALES MANAGER
E. P. Blanchard, Jr.
PROMOTION and RESEARCH MANAGER
W. H. Jack
ATLANTA.....R. H. Powell
BOSTON.....A. C. Boughton
CHICAGO and ST. LOUIS.....J. S. Costello, F. E. Bauman
CLEVELAND.....H. P. Johnson
DALLAS.....Gordon Jones, Douglas Billian
DETROIT.....C. A. Ransdell
LOS ANGELES.....C. F. McReynolds, D. T. Brennan
NEW YORK.....M. J. Storz
PHILADELPHIA....W. S. Hessey, J. D. Willis
SAN FRANCISCO.....William Woolston

BUSINESS

BUSINESS MANAGER.....J. G. Johnson
PRODUCTION MANAGER.....W. V. Cockren

RESEARCH AND MARKETING
Mary Whitney Fenton, Joan Read

Airline Costs Take Upswing 26
► No end seen to rising unit production and sales costs; fare increases a possibility.

F8U Hits 1,000 mph. Under Wraps 27
► Navy's F8U Crusader wins Thompson Trophy with official speed run of 1,000 mph.

USAF Asks Industry for Trainer Transports 29
► Air Materiel Command hopes to buy between 1,200 and 1,800 jet trainer transports off the shelf.

Transport Specialists Discuss Jet Era Problems 38
► More than 500 engineers attend turbine-power conference at Institute of Aeronautical Sciences meeting in San Diego.

MISSILE ENGINEERING
Vanguard Details Revealed 31

AERONAUTICAL ENGINEERING
Ivan Studies 55 Hours a Week 48
$50 Million Added to Quehanna 61
Fiat G.91 Makes First Flight 34
Super Sabres in Flight 37

AVIONICS
Dualex Offers 100,000 Codex 70
Skyscreen Plotting System 71
New Gunnery Trainer 75

SAFETY
Poor Approach Blamed for Crash ... 86

BUSINESS FLYING
Twin-Engine Bonanza Conversion 80
Business Aircraft Shipments 81
Plane Builds Business 82
Aluminum Feature of Transport 82
Private Lines 83
Spain Tests Trainer 85

TRANSPORT
CAA Tells Control Plan 40
Bogus' Parts Curbs Tightened 41
IATA Fare Plan Approved 41
Northeast Plans for Florida Run 42
Britannia Tours U. S. 43
CAB Approves No-Show Plan Phase .. 43
Two New Routes Awarded 45
Shortlines 45
Airline Observer 45
Airline Traffic—Second Quarter 46
Cockpit Viewpoint 47

FINANCIAL
Grumman Buys Hydrofoil 28

MANAGEMENT
Cessna Plant Planned 28
Farnborough Features N.113 29
Vertol, Sikorsky Sell to French 32
Eisenhower Air Program Issue 32
Continental Can Buys Transports ... 33
Who's Where 23, 90
Industry Observer 23
Washington Roundup 25
News Digest 33

Calendar 4
Letters 106

EDITORIAL
Sabotage in the Pentagon 21

COVER: North American F-100C Super Sabre is improved model over basic F-100 series design. It can carry atomic weapons, external fuel, has provision for in-flight refueling, and new avionic gear for bombing. Air Force's famed acrobatic team, Thunderbirds, recently were equipped with F-100Cs, and will show them off at National Air Show, Will Rogers Field, Oklahoma City, over Labor Day weekend. For more on F-100C, turn to p. 37.

66,973 copies of this issue printed

AVIATION WEEK • AUGUST 27, 1956 • Vol. 65, No. 9
Member ABP and ABC

B.F.Goodrich

De-Icers are going on more business trips than ever

FOR FLYING BUSINESSMEN, delay due to icing conditions can mean a meeting missed, a contract lost. They can't *afford* to be grounded. That's why the wings of most executive planes of twin engine size or larger are equipped with B. F. Goodrich De-Icers. They save time, eliminate delay, get businessmen to important appointments in spite of icing conditions encountered on the way.

B. F. Goodrich De-Icers make ice removal a snap! Small tubes within the De-Icer "boot" inflate and deflate to snap ice off cleanly into the airstream. The cycle operates automatically.

Here's how flight personnel of the Hoover Company feel about De-Icers on their DC-3 (top right photo): "We can always depend on B. F. Goodrich De-Icers. They enable us to plan and complete trips we otherwise wouldn't even schedule."

And other executives are ordering B. F. Goodrich De-Icers as original equipment on new planes like the Aero Commander (top left), Beechcraft D50 (bottom left), and Cessna 310 (bottom right). Of course, De-Icers can be installed on existing planes, too.

De-Icers for the latest executive aircraft are tailored to exact shape and simply cemented on without stretching or mechanical attachments. Result: smoother fit, easier maintenance, longer life. For time-conscious businessmen, B. F. Goodrich De-Icers are low cost insurance.

More and more manufacturers are installing B. F. Goodrich De-Icers as original equipment. Our engineers can help you in the design stage. We've been at it for 26 years. *B. F. Goodrich Aviation Products, a division of The B. F. Goodrich Company, Akron, Ohio.*

B.F.Goodrich

AVIATION PRODUCTS Tires, wheels, brakes • De-Icers • Inflatable seals • Fuel cells • Avtrim • Heated Rubber • Pressure Sealing Zippers • Rivnuts • Plastilock adhesives • Hose and rubber accessories

EDITORIAL

Sabotage in the Pentagon

International prestige of U.S. aviation and the morale of military pilots is being sabotaged in the Pentagon by the policies of Defense Secretary Charles E. Wilson. For almost a year Mr. Wilson has officially prevented any U.S. military aircraft from attempting to break the world speed record. This record is now held by England with an 1,132 mph. performance by the Fairey Delta.

Last November, when the record of 822 mph. was held by a North American F-100C, Mr. Wilson personally canceled an official attempt by the Chance Vought Crusader to set a new mark over 1,000 mph. The Crusader actually exceeded 1,000 mph. in practice runs over the official course, and, in the cool temperatures then prevailing at the optimum J57 engine altitude of 35,000 ft., there is no doubt that the Vought fighter could have set a mark that would have been beyond the reach of the Fairey Delta.

In the vacuum left by Mr. Wilson's cancellation of the Crusader run and a firm policy against allowing USAF to try with the McDonnell F-101 or the Lockheed F-104, the British took the record with the Fairey Delta's 1,132 mph. performance—a fine job of flying that raised British international aviation prestige measurably.

Why Censor Achievement

Now a year later, Mr. Wilson has allowed the Crusader to make an official speed run with the stipulation that it could make no attempt to surpass the British record. Under the hot weather prevailing over the Mojave desert in August, the Crusader had to go far above the optimum performance altitude of the J57 and sacrificed at least 120 mph. from its maximum possible performance because of temperature and altitude conditions.

Even so, the Crusader duplicated its better than 1,000 mph. performance of last November and will be awarded the venerable and famous Thompson Trophy that once went to pilots and planes who were allowed to go all out to give the best possible performance. It is a travesty on the fame and honor that go with the Thompson Trophy, the competence of U.S. aircraft designers and the skill of military pilots to conduct the 1956 affair under the disgraceful political limitations imposed by Mr. Wilson.

Both the USAF and Navy, as well as competent aeronautical technicians outside the military, agree that there is not one whit of military security involved in a 15-kilometer maximum speed run at altitudes well below the critical fighting areas of modern jet aircraft. Why then does Mr. Wilson insist that U.S. aviation achievements be concealed behind his screen of censorship? Is it because he and his immediate advisers are so technically ignorant on aviation matters that they really believe military security is involved? We can recall one of Mr. Wilson's technical security advisers telling us in all seriousness that newspaper reports of jet fighters point-to-point ground speed betrayed vital combat performance data and that the static sea level trust rating of a jet engine disclosed its genuine combat potential.

Or is this policy of Mr. Wilson's a simple result of his effort to throttle all news and discussion of military problems in the Pentagon and part of his effort to foist a facade of false security on the American people?

Secrecy vs. Morale

We don't profess to know what motivates Mr. Wilson in this policy. All we know is that for the first time in the history of U.S. aviation political restrictions are being placed on the technical achievements of the aircraft industry and the fine military pilots whose morale is a vital part of our national defense.

Another example of how Mr. Wilson's policies sap pilot morale is in the shameful handling of the 1,900 mph. flight by Lt. Col. Frank K. (Pete) Everest in the Bell X-2 rocket powered research plane (AW Aug. 6, p. 454). Pete Everest's Mach 2.9 performance was faster than man had ever flown before and, according to the technical experts, this simple fact betrayed not one whit of genuine military security data. In fact, the X-2 design speed of 2,500 mph. already had been officially announced by the Pentagon years ago. No USAF authority opposed disclosure of Pete Everest's tremendous achievement and Gen. Nathan F. Twining himself planned to announce it proudly in a public speech. All reference to the X-2 performance was deleted on Mr. Wilson's specific order. Only after a week of battling, during which the 1,900 mph. flight became common knowledge, did Mr. Wilson permit a single anonymous reference to a USAF pilot having flown faster than man had ever gone before.

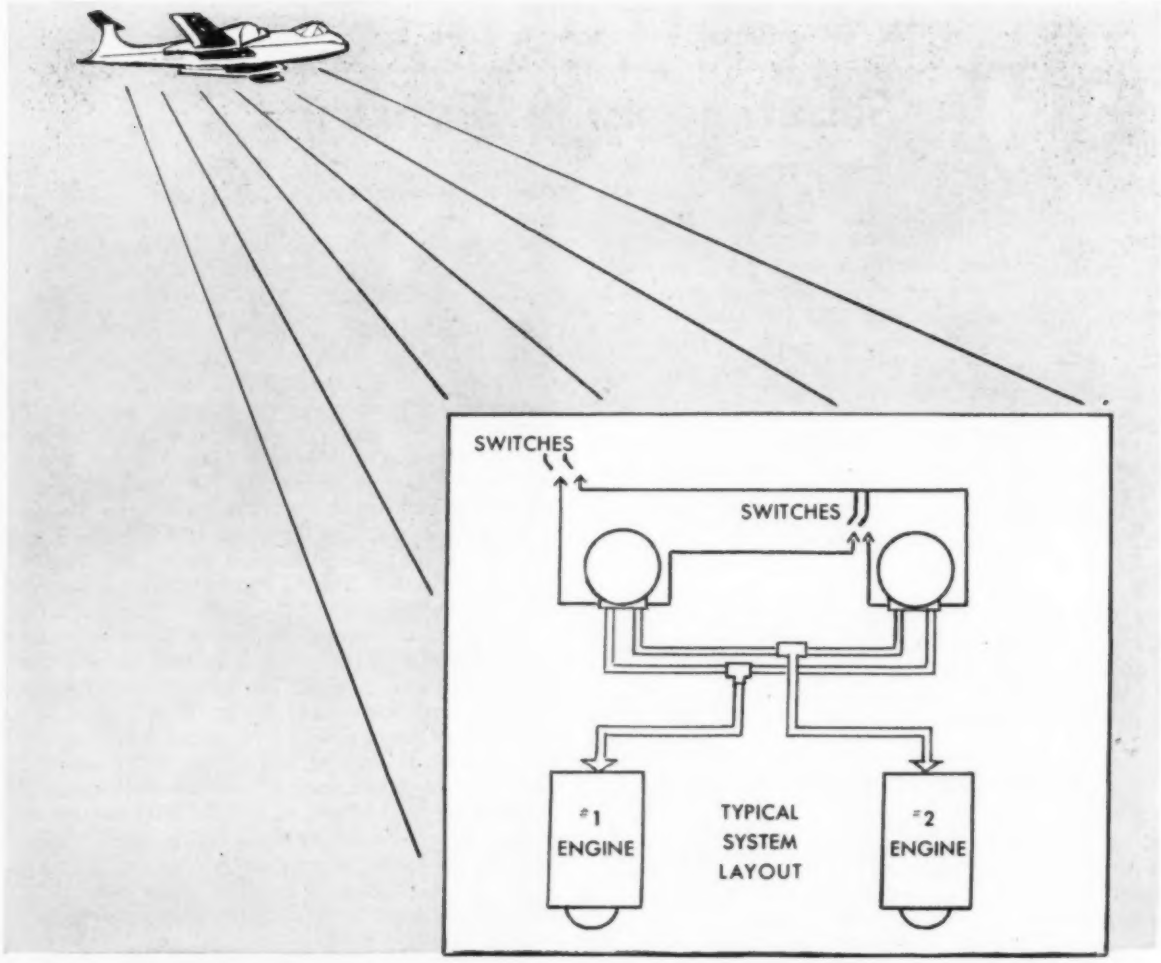
Disgraceful Reward

This is a disgraceful reward for the seven years of "beyond the call of duty" service that Pete Everest, a combat pilot in World War II, has logged at the USAF flight test center at Edwards AFB, flying all of the newest experimental fighters and research planes at pay that is a small fraction of what industry pilots collect for a lesser diet of danger.

The USAF test pilots at Edwards AFB over the past ten years have been one of the most selfless, skilled and devoted group of pilots in aeronautical history. Their contributions to the advancement of U.S. aviation through the sonic barrier to the edge of Mach 3 have been priceless to the national defense. Their names are a roll call of men to whom every citizen of this country owes a profound debt—Al Boyd, Chuck Yeager, Stan Holtoner, Pete Everest, Kit Murray, Fred Ascani, Jackie Ridley, Horace Hanes and many others, some of whom have paid for progress with their lives.

It is indeed disgusting to see these men treated in the shabby manner now meted out by corpulent civilian elder statesmen of the Pentagon who have no real understanding of the meaning of their achievements nor the sacrifices that make them possible. Continuance of these policies will do incalculable damage to the international prestige of U.S. aviation and the morale of military pilots.

—Robert Hotz



From Kidde:

Push-button fire fighting!

The extinguishing agent: CF_3BR, CB, MB, CF_2BR_2 or CO_2 . . . pressurized in "Main" and "Reserve" spheres of strong, lightweight steel.

The method of operation: Manual actuation (cable or electrical switch) by the pilot.

The discharge time: Almost instantaneous—from .5 to .9 of a second.

Designed and perfected by Kidde aviation engineers, specialists in aircraft fire fighting problems for more than 25 years, Kidde Nacelle Fire Extinguishing Systems offer dependable, fast-acting protection plus almost unlimited installation flexibility.

For recharging and service, Kidde has strategically located stations in the United States, Canada and throughout the world.

For further protection: The Kidde Aircraft Continuous Automatic Resetting Fire Detector, whose sensitive, nacelle-installed element immediately signals the pilot at the first sign of fire or abnormal engine overheat.

Kidde engineers are now working hand in hand with those interested in aircraft fire protection and safety, developing new extinguishing agents, corrosion inhibitors and special systems for ambient temperatures up to 250° F. Other Kidde aircraft safety projects include high pressure oxygen equipment, inflation equipment, flotation equipment, crash fire prevention systems, purging and pressurization systems.

If you have a problem involving aircraft safety, contact the manufacturer of more than 95% of the aviation fire extinguishing systems installed on U. S.-built planes. Write Kidde today.

Kidde (K Kidde) **Walter Kidde & Company, Inc., 918 Main St., Belleville 9, N. J.**

Walter Kidde & Company of Canada Ltd., Montreal—Toronto

WHO'S WHERE

In the Front Office

Samuel J. Spector, board chairman, and **Myles S. Spector**, president, Insuline Corporation of America, Manchester, N. H. Also: **William J. Schoenberger**, executive vice president, and **Bernard L. Cahn**, vice president and assistant secretary.

Frederick W. Marquant, board chairman, and **Mrs. Hilda F. Niedelman**, vice chairman, Aviquipo, Inc., New York, N. Y. Also: **Richard U. Surbeck**, president; **Fred J. Lazard, Jr.**, executive vice president and treasurer; **John V. Cartier**, vice president.

Sir Richard Fairey has resigned as managing director but remains executive chairman, Fairey Aviation Company Ltd., London, England. **Mr. Geoffrey W. Hall** has been appointed managing director.

Julius Fligelman, president of Los Angeles Period Manufacturing Co., elected board chairman of TelAutograph Corp., Los Angeles, Calif.

Paul Dollard, president-general manager, and **George Brubaker**, a director, Century Engineers, Inc., Burbank, Calif.

Howard M. Webb, president, and **Carl E. Hall**, vice president, of newly formed American Aerophysics Corp., Santa Monica, Calif.

Brig. Gen. Harrison Shaler (USA, ret.), Corporate Army Advisor to Aerojet-General Corp., Azusa, Calif.

Brig. Gen. William L. Bayer (USA, ret.), executive vice president-general manager Tele-Dynamics, Inc. (formerly Raymond Rosen Engineering Products, Inc.), Philadelphia, Pa.

V. H. Peterson, appointed vice president-engineering, Fairbanks, Morse & Co., Chicago, Ill.

Col. Jack N. Stovall has assumed duties of chief of the Airlift Division, Headquarters, Air Materiel Command, Wright-Patterson AFB, Ohio.

Honors and Elections

V. J. Braun, of the technical staff of Hughes Aircraft Co., was elected chairman of the Los Angeles Section of the Institute of Radio Engineers for 1956-57.

John P. (Jock) Henebry, president of Sky Motive, Inc., was elected president of the Air Force Association for 1956-57.

W. A. Patterson, president of United Air Lines, was elected a director of the Harris Trust and Savings Bank, Chicago, Ill.

Changes

Willard D. Landstrom and **Robert L. Perry**, engineering test pilots, Northrop Aircraft, Inc. Both men will be assigned to the Northrop-Radioplane flight test facility at Holloman Air Development Center, Alamogordo, N. M.

R. D. Fagley, manager-Mechanical Test Dept.; and **E. J. Masline**, instrumentation sales representative, United Electrodynamics, a division of United Geophysical Corp., Pasadena, Calif.

(Continued on p. 90)

INDUSTRY OBSERVER

► Flight test program for the Bell X-14 VTOL experimental test aircraft is awaiting delivery of Armstrong Siddeley Viper turbojets. X-14 will use a twin Viper installation.

► **Transition flights from the vertical to horizontal by Ryan's jet-powered VTOL are tentatively scheduled for October. Thus far, the aircraft has made both horizontal and vertical flights from Edwards AFB. However, there has been no in-flight transition involved.**

► Army's new Nike B interceptor missile has made several competitive flights against its Navy counterpart, the Talos, at the White Sands missile proving ground. The firings were directed against a B-17 drone as well as space points.

► **Convair will roll out its XB-58 Hustler medium bomber prototype on Aug. 31 at the Ft. Worth plant. USAF has officially approved the name Hustler for the first American supersonic bomber. Taxi tests are expected to run through most of September with the first flight scheduled for late September or early October. The Hustler is powered by four podded General Electric J79 engines.**

► Wright Aeronautical Division of Curtiss-Wright Corp. is developing a turbofan engine for the USAF for use in the early 1960s. Powerplant will be designed to have low specific fuel consumption at subsonic speeds and develop high thrust for speeds of up to Mach 3.

► **First fabricated parts for Lockheed's Electra turboprop transport will be produced in October. Electras are scheduled to become operational with U. S. airlines in 1958.**

► First nine Douglas DC-8s off the production line will be integrated into the flight-test program. Three of these will be powered by Pratt & Whitney J57 turbojets, four with Pratt & Whitney J75s and two with Rolls-Royce Conway by-pass engines. Some 12 DC-8s will be used by the airlines for shakedown prior to certification.

► **Southwest Airmotive, Dallas, has second USAF contract for overhaul of 1,400 Allison J33 engines. Value is more than $3 million. The firm is also expanding its business aircraft facilities at Love Field.**

► First project of Curtiss-Wright Corp.'s recently-acquired Turbomotors Division will be production of a 1,500-lb. thrust turbojet engine for use in trainers and target drones. Designated the Miniatur, the engine was developed before Turbomotors incorporation into Curtiss-Wright. A new plant for the division has been built near Trenton, N. J.

► **Aerojet-General Nucleonics will construct a low-powered nuclear research reactor in San Ramon, Calif., as a prototype for reactors the firm hopes to sell to private research institutions, colleges and universities. Designed to operate at a power level of 100 milliwatts, the reactor will use uranium enriched to 20% in the isotope U-235 as fuel.**

► General Electric's Aircraft Gas Turbine Division is developing a metal honeycomb compressor casing for use on future turbojet designs. Honeycomb is expected to make possible a substantial weight reduction.

► **Vertol Aircraft Corp., reports further progress in its fight against recurrent vibration problem in the H-21 helicopter. Company occasionally delays deliveries to find source of trouble and meet increasingly high Army standard before aircraft go into operation.**

► Pan Air Aviation, of New Orleans, is overhauling and modifying a Navy PBY for utilization by the French government as a cargo plane. The aircraft will be delivered to Tahiti for inter-island service when the overhaul is completed.

NEW DEPARTURES OF TODAY

Microscopic inspection of races, one of more than one hundred operations undertaken to insure the highest degree of uniformity and dependability.

Super-cleanliness is a byword in this ball bearing assembly and inspection area. It is completely air-conditioned and pressurized to keep out dust.

Volume source for *miniature* ball bearings!

These tiny steel "jewels" are available in a complete line, 3/8" (.375") outside diameter and smaller. They are made with super-accuracy on the finest equipment available—much of it designed by New Departure—to meet the most exacting requirements of today's precision industries. Performance and dependability of the highest order are assured.

For complete information about miniature ball bearings, or for help with any bearing problem, call on New Departure's expert engineering service. New Departure, Division of General Motors Corporation, Bristol, Connecticut.

WRITE FOR NEW DEPARTURE'S MINIATURE BEARING CATALOG

GM GENERAL MOTORS

NEW DEPARTURE

BALL BEARINGS

NOTHING ROLLS LIKE A BALL

Washington Roundup

AIA Job Open

Aircraft Industries Assn. board of governors is actively looking for a suitable candidate to succeed Dewitt C. Ramsey, retired Navy admiral, as president when his contract expires in November. Ramsey, who will be 68 in October, has made personal appeals to key aircraft industry leaders to stay on in the post but deep-seated dissatisfaction with the ineffectiveness of his regime in dealing with key industry issues has cast the die in favor of a successor. AIA will probably offer Ramsey some sort of retirement benefits to supplement the retirement pay he already draws from the Navy. There is some industry speculation that K. B. Wolfe, former chief of USAF procurement, and recently resigned from Oerlikon may be in the running for the AIA post.

New Look for Secrecy

Defense Department's monster file of classified information is due for an overhaul and so is the system that has brought it to such mountainous proportions. Charles A. Coolidge, Boston attorney who has been named by Secretary Charles E. Wilson to do something about stopping "leaks," has tackled his job with a refreshing outlook.

He suspects there should be fewer secrets and that when the stamp is put only on the genuine article, people will have more respect for what it means. Coolidge is not interested in control of unclassified information, and his arrival in the Pentagon marks the definite death of the Karl R. Honaman School that preached this doctrine.

He is eager for the opinions of engineers, scientists, industrialists and the press. He is interested in examples of secrecy serving to impede progress. He feels that the Defense Department must separate its problems of secrecy for security from those of discipline in the ranks of the armed forces.

Elections and Aviation

Although temporarily obscured by the heat of the political conventions, a number of senators who have been particularly active in aviation matters were fighting their own battles for re-election last week. They include four Democratic members of the Commerce Committee which has jurisdiction over civil aviation:

• **Sen. A. S. Mike Monroney (D.-Okla.).** As chairman of Commerce's Aviation Subcommittee, Monroney has taken the lead in successfully pushing legislation for an expanded airport aid program, permanent certification of local service airlines, and other measures. His Republican opposition—Douglas McKeever, Enid, Okla., lawyer and state Republican chairman—could make it a close fight, but the state is controlled by a Democratic administration, and Monroney is favored to win.

• **Sen. Warren Magnuson (D.-Wash.).** As chairman of the full Commerce Committee, Magnuson has given Monroney strong backing on aviation. He faces Washington's Republican Gov. Arthur B. Langlie in what is expected to be one of the nation's closest senatorial races. The odds generally favor Magnuson.

• **Sen. George Smathers (D.-Fla.).** As chairman of a special Commerce Subcommittee, he pressured the Eisenhower administration into granting industry participation in the negotiation of bilateral air agreements. He won in the May 9 Florida primary and has no opposition in the final election.

• **Sen. Alan Bible (D.-Nev.).** Protege of the late Sen. Pat McCarran who was a co-author of the 1938 Civil Aeronautics Act, Bible was elected to succeed McCarran in 1954. During two years service on the Commerce Committee, he has conscientiously attended aviation hearings, but generally followed the advice that newcomers be seen and not heard. He is expected to triumph over three opponents in the Sept. 4 Democratic primary. If he succeeds, he will face Rep. Clifton Young (R.-Nev.) in the election.

Two members of the Senate Airpower Investigating Subcommittee, headed by Sen. Stuart Symington (D.-Mo.), are up for re-election:

• **Sen. Sam J. Ervin (D.-N.C.),** who supported Symington's campaign for a stronger airpower program, has no opposition.

• **Sen. James H. Duff (R.-Pa.),** who led the Republican defense of the administration's program against Democratic attacks that it was inadequate. Duff faces the opposition of Joseph Clark, former mayor (1952-56) of Philadelphia. With the state and Philadelphia controlled by a Democratic administration, the Pennsylvania senatorial race is expected to be close.

Other senatorial candidates include:

• **Sen Wayne Morse (D.-Ore.),** who has sided with independent airlines in several floor speeches, is opposed by former Secretary of the Interior Douglas McKay.

• **Sen. Olin D. Johnston (D.-S.C.),** who, as chairman of the Post Office Committee, was the major roadblock to Postmaster General Arthur Summerfield's proposal to increase the airmail postage rate from six to seven cents an ounce. He will receive only token Republican opposition from L. P. Crawford, mayor of Clemson, S. C.

Finletter for Single Service

Thomas K. Finletter, former Air Force Secretary and now the Democratic campaign manager in the presidential race, is a strong advocate of a single military service. He has predicted that Gov. Adlai Stevenson, if elected, will buy the plan and push it. The over-riding fact, however, is that any decision on defense re-organization is up to Congress, and Congress is overwhelmingly against the single service plan.

Foot-Dragging, Soviet Style

Pan American World Airways' hopes of operating directly to Moscow within the immediate future have been dampened by Soviet foot-dragging. When the Russians first suggested conversations on Moscow operating rights for Pan American, it appeared that the American carrier would soon be able to serve the routes it bought along with American Overseas Airlines in 1950. Now it seems that the Russians are only interested in an interline agreement. Pan American is going ahead with negotiations for interline service in the hope that it will be a first step towards direct service to Moscow.

Railroads vs. AIA

Chances are considered good that the Interstate Commerce Commission will suspend efforts by the railroads to increase demurrage charges on freight cars. Aircraft Industries Assn. is only one of many trade groups protesting the new schedule slated to go into effect on Saturday. New rates for freight cars that stand idle would run as high as $10 a day, including holidays. ICC can approve new prices or suspend them for a period of up to seven months.

—Washington staff

Airline Costs Take Upswing, Hit Profits

No end seen to rising unit production and sales costs; fare increases possible though investigation pends.

By Craig Lewis

Washington—Trunk airlines' unit production and sales costs, on the rise for the last nine months, will continue to rise, reversing a seven-year downward trend and increasing industry speculation that there may be fare rises.

While total expenses have increased steadily through the years, traffic growth plus increased efficiency of aircraft and personnel have kept unit costs on the decline. Now the expenses of expanding service and operating more costly aircraft have arrested the decline. Unit costs are creeping up.

Most of the trunk lines showed extremely robust profit margins during the first half of the year, but airline officials are keeping an uneasy eye on their costs. With another uneasy eye on the Civil Aeronautics Board general-passenger-fare investigation, they are saying that fares must stay at their present levels. They may have to go up, if profits are to remain reasonable.

Unit-Cost Value

While some experts downgrade the unit-cost system as a true measure of airline expenses, it is still the most reliable way of telling a carrier what it costs to produce and sell its product in relation to the product revenue.

Since 1948 and through the end of 1955, unit costs moved generally downward. Cost per revenue ton-mile declined from 58.6 cents in 1948 to 45.4 cents last year; cost per available ton-mile followed the same trend.

While expenses were decreasing, unit revenues also were declining. Fare levels have remained constant, but as lower-fare coach and family-plan traffic became a bigger part of total business, revenue per ton-mile decreased.

Unit revenues and expenses have both declined in the last eight years, but the two curves have moved closer together as they have moved downward, narrowing the airlines' profit margin. The margin widened in the boom year of 1955, but is closing again.

In the past, as total costs have grown, revenues have grown, giving the airlines a bigger volume of business over which they could spread their expenses. Internally, unit costs have been kept down through substantial increases in personnel and aircraft efficiency.

Direct expenses of flight operations have generally increased with the growth of airline business. These expenses include costs of flight crews, fuel, depreciation on flight equipment and maintenance.

Flight crew unit costs declined from 1948 to 1955 largely because of the introduction of higher capacity transports. At the same time, fuel costs rose on a unit basis. This was a penalty paid for greater power and higher speed.

Depreciation unit expenses have fluctuated since World War II. They were high in 1947 and 1948 because of rapid writeoffs on used DC-3 and DC-4 equipment. Then they declined when the airlines started getting newer equipment and moved into a five to seven-year depreciation cycle.

Depreciation moved upward again in 1953 and 1954 with the delivery of a new round of equipment orders. Last year, it declined again as aircraft bought five years earlier were written off under Office of Defense Mobilization fast tax amortization certificates. Also, fewer deliveries of new equipment were made last year.

An important factor in the historical decline of unit costs was the decrease in ground and indirect expenses. This is an area where management can exercise greater control over costs, as opposed to direct expenses with fixed outside costs.

Between 1948 and 1955, ground and indirect expenses declined from 31.2 cents per revenue ton-mile to 21.7 cents. At the same time, these expenses shrank as a portion of total costs. In 1950, ground and indirect expenses were 50.6% of the total expenses per revenue ton-mile; in 1955 they were 47.8% of the total.

Declining trunkline unit costs flattened out late in 1955 and reversed their downward trend. In the fourth quarter of last year, unit expenses started to move upward, and the trend has continued through 1956.

A key to the reversal lies in increased costs of parts and labor in maintenance operations. While flight crew and fuel expenses have held fairly steady and depreciation charges per revenue ton-mile have actually declined, direct maintenance costs have risen sharply.

Ground and indirect expenses also have taken an upward turn. Part of the increase is due to a new round of airline hiring to provide for traffic growth.

To many airlines, rising costs have been the price of good fortune in recent route cases. Costs of opening stations to handle new route operations have forced up indirect unit costs for all but advertising and publicity.

Another important factor in recently rising costs stems from the introduction of new equipment, such as the DC-7 and the Super-G Constellation, during the past two years. For the first time since World War II, the airlines moved to new airplanes with higher unit costs than the airplanes they replaced. As the new aircraft came into volume use, costs moved upward.

The DC-7, for instance, has cost more than the DC-6B to operate as it moved into the full overhaul cycle after its introduction late in 1953. For 1955, direct flight costs for the DC-7 were 24.6 cents per revenue ton-mile and 13.6 cents per available ton-mile as compared with 22.1 cents and 12 cents for the DC-6B.

Most trunk airline officials, shy about discussing costs now because of the impending fare investigation, think that unit costs will continue to rise in company with total costs.

Costs vs. Fares

Some observers believe the larger airlines may have reached the point where added capacity will have a diminishing effect in reducing costs. One official said the airlines are "running out of steam on economies which can be effected by growth itself." Another fears that new competition will cut traffic growth for individual carriers.

Most of the trunk airlines reported substantial net profits for the first half of 1956—American Airlines made $10.7 million, Eastern Air Lines made $7.5 million, United Air Lines made $5.2 million. Two major carriers—Trans World Airlines and Capital Airlines—reported losses.

TWA had a net loss after taxes of $5,396,000 in the first half, most of it caused by a 22% increase in expenses while revenues increased only 13%. The carrier attributes the cost increase to the expenses of moving into a new engine overhaul facility at Kansas City and a "drive for better service."

TWA admits it may have fallen behind somewhat in improving service and says that "catching up" costs a lot of money. The airline has hired 2,500 new employes in its program.

Capital lost $1,609,811 in the first six months of the year. A contributing factor was increased depreciation charges for the new Viscounts Capital has been receiving weekly.

Capital is moving into a number of new markets as the result of several CAB route decisions. Right now, establishing new facilities is costing money in anticipation of future revenues. Capital's expansion program has involved hiring 1,700 new employes during the last 18 months.

McDONNELL F3H-2N Demon all-weather fighters (below, right) will make high speed formation flybys and will be shown in ground display at National Aircraft Show. Four interceptor rocket packages and two external fuel tanks hang from plane shown above. Demon, powered by Allison J71 turbojet, is on duty with Navy operational squadrons.

F8U Hits 1,000 mph. Under Wraps

By Claude Witze

Oklahoma City—U.S. Navy's F8U Crusader won the 1956 Thompson Trophy last week with an official speed run of more than 1,000 mph. Official announcement of the new record will be made at the National Aircraft Show here on Labor Day.

The Chance Vought jet fighter set the mark in two officially-timed passes over a 15.1 kilometer course at the Naval Ordnance Test Station, China Lake, Calif. Acting under Defense Department orders forbidding any U.S. military plane from competing for a world speed record, performance of the F8U was kept below its maximum capability by the pilot, Cmdr. Robert W. (Duke) Windsor, 37.

Flying without these restrictions and under favorable weather conditions, the Crusader would be capable of challenging the British-held record of 1,132 mph. set by a research plane, the Fairey Delta FD2.

Actually, the record set last week duplicates a previous effort by the F8U. The plane hit an average of 1,050 mph. in runs held last fall in preparation for an official assault on the record. Only 48 hours before the attempt was scheduled, Defense Department canceled the program (AW Dec. 19, p. 7).

Last week's Thompson Trophy dashes were made at about 43,000 ft. altitude. Winds were fairly constant at 45 knots. Two passes were made over the course, one from the north and one from the south.

The speeds were averaged to reach the new record figure.

Timers were Charles Logsden and

Bertrand Rhines of the National Aeronautic Assn.

Award of the Thompson Trophy to the Navy on Labor Day will be the climax of the three-day stand of the aircraft show at Oklahoma City's Will Rogers Field.

The big annual military and industry exhibit is chalking up record advance ticket sales on its first visit to the Southwest.

The show management says the weekend crowd may surpass last year's record of 289,800 at Philadelphia. Quality of the industrial exhibits is expected to set a new high.

Every major airframe and engine manufacturer will be represented among the 58 industry exhibitors, and the equipment and aircraft displays will be spread through five hangars and across all available outside ramp space.

While the Oklahoma City area is more sparsely populated than previous show sites in Cleveland, Dayton and Philadelphia, aviation enthusiasm runs high in this particular part of the country, and visitors are expected from hundreds of miles around the Oklahoma capital.

In addition to the armed forces, the Oklahoma City Chamber of Commerce is working to promote the show throughout the Southwest. Advance ticket sales are running almost twice as high as they did a year ago in Philadelphia.

Hotel space is at a premium.

Bendix Trophy Race

Opening headline event on Saturday will be the Bendix Cross-Country Trophy Race flown by six North American F-100C Super Sabres of USAF's Tactical Air Command. They will fly from George AFB near Victorville, Calif., to Oklahoma City—a distance of 1,120 miles.

Pilots can carry external extra fuel tanks or use aerial refueling. They will be permitted to fly at supersonic speeds, but not below the 5,000-ft. altitude level on their approach to the finish pylon.

Last year's Bendix Race, flown from George AFB to Philadelphia, was won by Col. Carlos Talbott in a North American F-100C with an average speed of 610.726 mph.

On Sunday, three Boeing B-47 Stratojet bombers of the Strategic Air Command will compete for the General Electric Trophy on a run from Bermuda to the aircraft show, a distance of 1,900 mi. In addition to flying against the prevailing winds, the planes will be denied aerial refueling on the flight and must land at Oklahoma City with a minimum of 15,000 lb. of fuel in reserve.

Weather and navigation skill are expected to play a major part in determining the winner of the event.

Last year's General Electric race was won by a B-47 crew from March AFB, Calif., who flew to Philadelphia from their home station at an average speed of 589.294 mph.

The 1956 mark probably will not reach the 1955 figure, because of the adverse winds.

This year's Allison Trophy event, like last year's, will be an engine-change contest. Ground crews of USAF's Air Training Command will compete in runoffs on the first two days of the show, the winners entering the final race on Labor Day. Teams of five men plus a crew chief will replace the Allison J33 engine in Lockheed T-33 jet trainers.

F-104 on Display

Additional USAF activity will include display of 189 aircraft, newest of which will be the Lockheed F-104 day superiority fighter and the Lockheed C-130 Hercules turboprop transport. USAF's portion of the air show will run for approximately one hour and 15 minutes and feature sonic booms by eight F-100 supersonic fighters, a "scramble" by two Convair F-102 interceptors and formation flybys by other operational fighters and bombers.

A strike against an enemy airfield will be simulated by three RB-66 light bombers from the Tactical Air Command.

It will be followed by flybys of Republic F-84F Thunderstreaks and North American F-100's, a paradrop by Fairchild C-119s and a simulated resupply drop from Douglas C-124 transports.

The Navy and Marine Corps will have about 100 aircraft in the flying and static shows. Newest item is the F8U, which will perform for the first time before the public. In addition, the crowd will see the Grumman F11F Tiger, and F9F-8 Cougar jets will produce sonic booms. Carrier landings will be enacted on the field by F7U Cutlasses.

Army Display

In the Army show, troops carried by Vertol H-21 helicopters will "seize" the airport in a mock 20-minute battle aided by equipment flown in by Sikorsky H-34s. Other Army planes also will be demonstrated. Army Aviation Center, Ft. Rucker, Ala., is responsible for the Army show.

Major highlight for the aircraft industry will be the Aircraft Industries Assn. dinner for foreign air attaches on the evening of Aug. 31. Speaker at this event will be Lt. Gen. Clarence S. Irvine, USAF deputy chief of staff for materiel.

About 60 foreign representatives will attend.

New $10 Million Plant Planned by Cessna

Four-phase plant expansion program to cost approximately $10 million will be started immediately by Cessna Aircraft Co., just north of its Prospect, Kan., plant.

Program will include a completely new self-sustaining factory adding 425,000 sq. ft. of covered area to the company's current 1 million sq. ft. New facility is planned for an ultimate expansion to 750,000 sq. ft. It will be named the Wallace Plant, after Cessna President Dwane L. Wallace.

The Wallace Plant will provide increased production of the Cessna T-37A twin-jet side-by-side trainer for USAF. Current contract status of the T-37A exceeds $26 million. Wallace also pointed out that the company is undertaking the expansion because of the bright future for business aircraft sales, indicating that it plans considerable increase of its present record-breaking civilian plane output.

First phase of the new plant will be completed by mid-1957, including a 50-ft. wide taxiway connection to Wichita Municipal Airport. Phase 2 will be finished in late 1957, phase 3 by the fall of 1958 and phase 4 by 1960.

Grumman Buys Into Hydrofoil Company

Grumman Aircraft Engineering Corp. has bought half interest in Dynamic Developments, Inc., Islip, L. I., a hydrofoil research organization which now has a small Navy research contract.

Besides producing amphibious aircraft, Grumman makes a line of metal pleasure boats, and the association is expected to produce ideas for use in both fields.

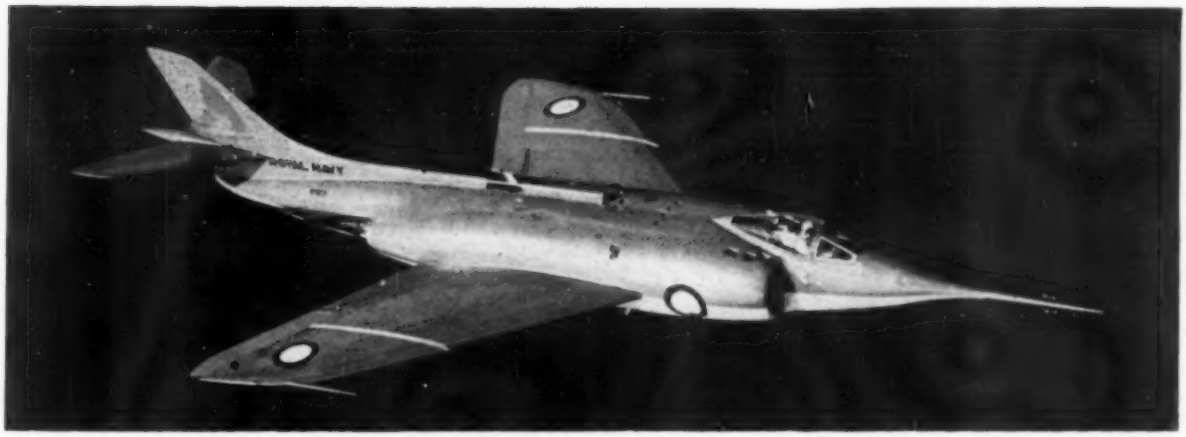
Initial studies will concern military boat and aircraft applications.

William P. Carl is president of Dynamic Developments. Associated with him as Robert R. Gilruth, assistant director of the NACA Langley Memorial Aeronautical Laboratory. He is a director of Dynamic Developments.

Hydrofoils, extending from a hull, create lift like an airfoil when speed increases, lifting the hull out of the water.

The result is less friction and increased speed.

Hydrofoils are almost as old as flight, but new techniques have reawakened interest in the concept. The Navy has let several other research and development contracts recently besides the one to Dynamic Developments. Grumman currently is producing one amphibian, the SA-16A Albatross.



First Air-to-Air Picture of N.113

Vickers Supermarine N.113, twin-jet day fighter for the Royal Navy, is shown in its first air-to-air photo. The N.113 made its first flight last February. The N.113 is a development of the Type 525 experimental aircraft demonstrated at Farnborough in 1954. Major differences include slab tail and toothed leading-edge extension on the outboard panels. Super-circulation will be fitted to N.113 to increase lift during carrier operations. Design evolution of the N.113 dates back to the straight-winged V-tail Type 508, more than five years ago. Powerplants remain a pair of Rolls-Royce Avons rated at better than 10,000 lb. thrust each.

Farnborough Show to Feature Supermarine

London—One almost-new fighter and a number of engine flying testbeds will feature the flying display at this year's Society of British Aircraft Constructors' show at Farnborough, Hampshire next week.

The expected curtain-raiser will be the flyby of a group of the RAF's Avro Vulcan delta-winged bombers.

The Vickers Supermarine N.103, although not in its final production configuration, will be the latest fighter entry.

In the powerplant demonstrations, turboprop, turbojet and rocket engines new to the Farnborough display will be carried aloft in a large variety of airframes.

A possible last-minute entry is the Rolls-Royce VTOL, although most observers expect the aircraft will not be flown.

Other dark horses include two Miles airplanes: the Student jet trainer and the Aerovan modified to the Hurel-Dubois formula with very high aspect ratio wings.

Powerplants to be shown in flight at their first SBAC display include: Bristol Orion supercharged turboprop in a Britannia test bed; de Havilland Gyron turbojet in a Short Sperrin; Napier Scorpion rocket engine in an English Electric Canberra; Rolls-Royce RA. 29 Avons in another Canberra; Rolls-Royce Tyne turboprop in the nose of an Avro Lincoln test airframe; Rolls-Royce jet reverser on the Avon-powered Hawker Hunter; de Havilland Super Sprite rocket engine on a Vickers Valiant bomber.

The Fairey Fireflash missile will be flown in underwing paired mounts on a Hawker Hunter.

USAF Asks Industry For Trainer Transports

Wright-Patterson AFB, Ohio—USAF is in the market for between 1,200 and 1,800 small and medium-jet trainer transports. Air Materiel Command hopes to buy the aircraft off the shelf.

AMC has asked 28 manufacturers to consider developing the aircraft for joint commercial-military sales. The new aircraft will be used to replace B-25s and C-45s currently used for transport and training missions and move this activity into an all-jet operation. AMC seeks these planes:

• **Light twin-jet utility trainer,** with a range of about 1,500 nautical miles, a crew of two and passenger capacity of at least four. Primary mission will be combat readiness training. The aircraft must have a service ceiling at design takeoff weight of 40,000 ft.; maximum cruise altitude of 45,000 ft., and cruise speed of Mach .76 (550 mph).

• **Medium weight four-jet utility** transport trainer, with a normal range of 1,500 nautical miles and provisions for a crew of two and eight passengers. Primary mission will be fast movement of critical documents and cargo. Extended range should run up to 2,200 nautical miles against 70-knot headwind. Service ceiling at design takeoff weight must be 40,000 ft., maximum cruise altitude, 45,000 ft. Cruising speed must be the same 550 mph. called for in the twin-jet plane.

In his letter to the manufacturers, Maj. Gen. David H. Baker, AMC director of procurement and production, said he expects to pay between $200,000 and $400,000 each for the planes. He asked the firms to indicate within 60 days whether they will undertake development with their own funds.

AMC pointed out that USAF's own development funds are critically needed for work on advanced weapon systems and must be spent to improve combat capability.

In addition, it said industry can afford to develop the trainer-transport types and exploit both the military and commercial sales possibilities.

AMC's approach was interpreted as a return to pre-war policy of asking manufacturers to build prototypes at no cost to the government.

After evaluation, the USAF will select production contractors. In the event that more than one acceptable prototype is submitted, formal procedures will be used by an evaluation team to pick the winner.

Manufacturers interested in the competition are Fairchild, Northrop, North American, Convair, Cessna, Beech, Temco and Lockheed.

Industry observers expect that some of these firms will find they are too busy with contracts for combat-type aircraft to take part in the program. Some of the smaller firms invited to submit proposals may not have the capital to invest in the project.

One possibility is that the Navy may find a way to coordinate its requirements with those of the Air Force.

Traffic Controllers Fight to Halt Pay Cut Ordered by Civil Service

By L. L. Doty

Washington—Air traffic controllers will begin a last-ditch fight this week to block a pay-grade ruling by the Civil Service Commission which, they say, would touch off an exodus from the control tower.

The new ruling affecting the already manpower-shy controllers was drawn up as the result of a three-year struggle by the Civil Aeronautics Administration to have air traffic control, tower and communications operators upgraded in the Civil Service Commission pay structure.

Actually, the CAA and controllers say, the formula accomplishes something far different—"downgrading at a substantial number of facilities, very little upgrading."

No Upgrading

Essentially, the formula was established to provide a wage differential between controllers manning low and high-activity centers. The purpose was to create an incentive that would encourage experienced controllers to bid for positions in high-pressure areas such as New York's LaGuardia and Chicago's Midway airports.

At present, a low-density controller has a pay grade equivalent to that of a high-density controller, and it is understandably difficult to attract experienced personnel to stations at which air traffic is sustained at a high level.

Opposition to the formula stems from the fact that, under the new plan, controllers at larger stations will not be upgraded; the pay-scale difference will be accomplished by the downgrading of personnel at smaller stations.

In opposing the move, the CAA has persuaded the Civil Service Commission to postpone the original Sept. 1 deadline for putting the ruling into effect in order to give the administration more time to avoid excessive downgrading. Clifton Burton, director of the Air Traffic Controllers Assn., has urged that the proposed standards "be set aside and an immediate and fresh approach be taken."

CAA's main objective is to broaden the formula to provide for more upgrading of personnel with emphasis on controllers assigned to high-density areas.

Even without the anticipated downgrading, the CAA is having trouble retaining its controllers, who can demand relatively-higher salaries from private industry.

Consequently, airlines are being forced to restrict schedules because some towers and centers are not sufficiently staffed to handle traffic demands. And the situation is growing worse.

Under the present system, controllers in all areas earn an annual minimum of $5,915. Under the new standards, controllers in high-activity areas will continue to receive that amount while those in other areas will be downgraded to a minimum $5,440.

Upgrading will be confined to chief controllers in larger stations. They will be jumped one grade from a $6,390 minimum to $7,570.

Chief controllers in smaller stations will remain at the $6,390 level. Assistant controller positions, which now carry an annual minimum of $4,524, will be abolished.

Criteria for putting a station in the high-activity category are:

- **Average of 13,500** or more total operations per controller annually.
- **Average of 350 or more** IFR approaches per controller annually.
- **Volume of traffic must be** such as to require three positions of controller operation in excess of 350 hours per month.

CSC Position

The Civil Service Commission claims that, while some downgrading will result, the number of individuals affected will be small, since the number of controller positions in high-activity areas will be larger than at present. The commission concludes that, "since the CAA plans to make necessary personnel changes through transfer and reassignment, no general downgrading of employes is expected."

It was to enable the CAA to make these transfers that the commission postponed the effective date of the new standards.

Present low-pay standards already has created conditions such as these:

- **Temporary discontinuance** of PAR (Precision Approach Radar) and Stromberg Indicator facilities at one large station was requested because of insufficient technicians to maintain the unit. A 60% turnover of radar technicians in this station is attributed to low salary of radar technicians.
- **No applicants** answered a publicized bid for ten controller positions at another center, and the jobs were finally filled by recruits taken from "off-the-street." (Controllers estimate it takes two years to train a man thoroughly.)
- **"Equipment** is adequate for the job at hand today," one controller explains, but this is no help when we don't have enough men to work that equipment at its peak output."

The controller cited a case of ILS traffic being held in a stack while the only controller on duty was forced to devote his efforts to bringing down GCA on a disabled C-46.

- **Controllers consider** themselves "professionals," but the Civil Service Commission does not.

A commission spokesman explained that it is difficult to compare the controller's position with more familiar jobs. He suggested that the controller belonged in the clerical category.

Commerce Backs CAA

The Department of Commerce has joined the CAA in taking a strong stand behind the proposed amendments. It has accused the Civil Service Commission of considering the work-load of the controller with the same yardstick that is applied to "processing applications, punch cards or lawsuits," adding that air traffic "is not workload which can be reduced to numbers for purposes of arriving at pay."

The department said the controller should be paid for maintaining a "high degree of very special skill" and for applying these skills "unerringly with no margin for error." It also pointed out that the consequences of error are incalculable "since human life is involved" and that the job calls for fast judgment which "permits no second-guessing."

CAA Proposals

CAA's proposed amendments would divide airport control towers into three categories—high activity, moderate activity and low activity. Tower chiefs under the CAA grade structure would receive an $8,990 minimum; supervisors would earn $7,570 and controllers $6,390. Corresponding positions in moderate-activity towers would be one grade less (or about $7,570 for a tower chief) than positions in high activity towers. Those in low-activity towers would be two grades lower than controllers in the top category. Air Route Traffic Control Centers would be divided into two categories—"more complex and complex." Controllers in "more complex" centers would be paid on the same scale as high-activity tower controllers; those in "complex" centers would be placed on the same level as moderate activity tower positions.

The Civil Service Commission told AVIATION WEEK the proposals will receive prompt study and consideration.

The Air Traffic Control Association, which was formed a year ago and now has a membership roll in excess of 1,600, would go a step further and boost all positions one grade above the CAA proposals.

More Vanguard Details Are Revealed

Detroit—Some construction details not hitherto revealed of the Vanguard satellite to be launched during the International Geophysical year were disclosed last week by Brooks & Perkins, manufacturer of the spheres. Prime contract for the overall Vanguard project has been awarded to Glenn L. Martin Co.

E. Howard Perkins, president of Brooks & Perkins, said his company had arranged to build 15 or 20 satellites for initial experimentation and probably would build others later.

There was no estimate of the cost involved in the manufacture of these. The company probably will be paid on a cost-plus-fee basis on an open-end contract.

It was brought out at the meeting that the thickness of the skin on the satellite has been changed. It will not be uniform because of antenna housings and for other reasons. The thickness of the skin was given as .03 in. compared with the .02 in. previously mentioned.

Interior Bracing

The satellites, 20 in. in diameter and about 4 lb. in weight, are being made of a lightweight alloy composed of 95% magnesium, 3 to 3¼% aluminum and about 1% zinc. Interior bracing consists of magnesium tubing with some use of plastic. The plastic was identified as "Kel-F," and said to be resistant to heat with low thermal conductivity.

The magnesium skin will be secured to the bracing with screws. There are several feasible ways to seal the sphere and method used will vary with the type of test being flown. It could be welding or mechanical joint.

The outside of the satellite will be manufactured to a tolerance of four micro-inches and then polished to an intense mirror-like finish. This finish is desirable as an aid to observation. Scientists have said the sphere will be visible to the naked eye as it sails through the heavens, but that binoculars will give a much better view.

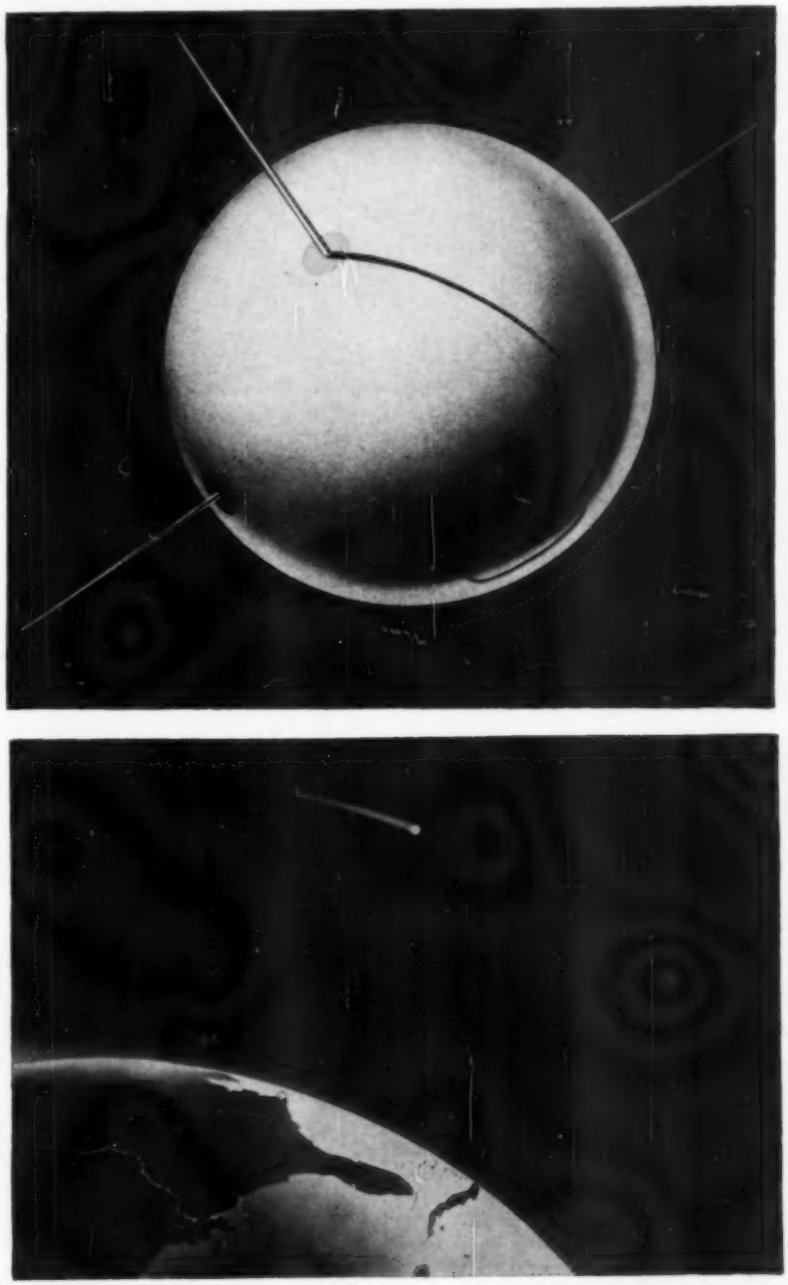
Satellite Orbit

Orbit of the satellite will be roughly elliptical. It is now calculated that the body will maintain a minimum distance of 200 mi. from the earth with a maximum of 1,500 mi.

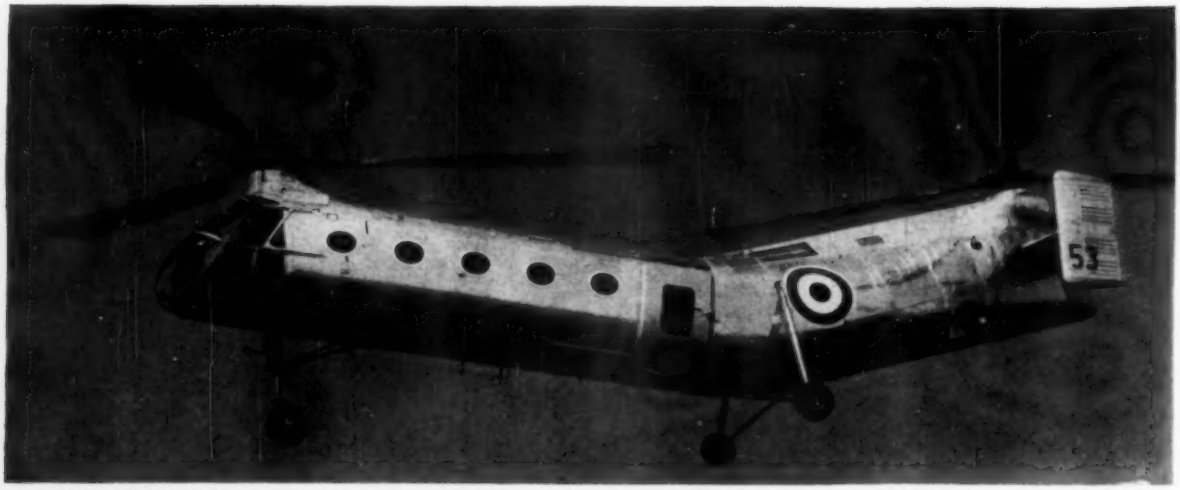
The orbit is expected to change constantly due to perturbation caused by the earth's density.

Life of the satellite is expected to be anywhere from two weeks to one year. When it slows it will re-enter the earth's denser air and be consumed by fire. It will not burn on departure from surface of the earth because the acceleration rate will be much slower. In addition, it will be protected by its nose cap.

Present plans call for the launching of the first satellites some time after July 1, 1957, beginning of IGY, from Cape Canaveral near Patrick Air Force Base, Fla. Construction of the launching pads at the Cape has begun but some qualified observers believe prior delays could move the firing date into 1958.



FLIGHT of satellite, built of polished magnesium alloy by Brooks & Perkins, will be visible to the unaided eye as it passes along its orbit. Mirror-like finish of the instrumented sphere will be protected during flight into orbit by nose cap of third-stage launching rocket. Emptied third stage will also orbit, following the artificial satellite, but its configuration will have higher drag, producing a shorter life.



VERTOL'S H-21 Work Horse ordered by French Ministry of Defense. Latest order of 50 brings to 100 number to go into service for French Army. Original 50 ordered last March have seen service in Algeria. Work Horse also has been in extensive service with U. S. Army, U. S. Air Force and Royal Canadian Air Force.

Vertol, Sikorsky Sell More Units to French

Washington—Two major American manufacturers last week appeared to be running neck and neck in their spirited competition to sell helicopters to the French Ministry of Defense.

• **Vertol Aircraft Corp.**, Morton, Pa., said Paris has decided to award a follow-on contract for 50 H-21 Work Horse helicopters with deliveries to begin about the middle of 1957. This order would bring the total of H-21s shipped to France to 100.

• **Sikorsky Division**, United Aircraft Corp., has licensed Soc. National de Constructions Aeronautiques du Sud-Est (Sncase) to assemble 100 Sikorsky S-58 helicopters in France. Parts will be shipped from the U. S. The contract is understood to be the first step in a program under which the French eventually will manufacture the entire aircraft.

Vertol said the Societe Nationale de Constructions Aeronautique du Sud-Ouest (Sncaso) has been commissioned by the French government to provide maintenance and repair for the H-21s both in France and Algeria.

The Vertol and Sikorsky helicopters have been used by French military forces in North Africa for the past several months.

The equipment has been there for practical combat reasons, but, at the same time, has been undergoing a comparative evaluation.

Both State Department and military secrecy have hampered movement of news from the front in Africa, but U. S. Army observers are known to be on the scene. The Army long has been interested in comparative performance and operational costs of the H-21 and S-58. Army designation for the latter is H-34.

According to Vertol, performance of the H-21 in Algeria over the past few months was responsible for the French decision to double the original order.

While the company has made no announcement, it was learned that another 26 Vertol H-21s have been sold to the German government.

New Helicopter Record

A new world helicopter non-stop distance record of 1,199 mi. was claimed by the U. S. Army last week. The mark was set by a Vertol H-21C Work Horse equipped with three extra 300 gal. fuel tanks in the cargo compartment.

The record was set over a closed-circuit course of 85.6 miles between Heightstown and Haddonfield, N. J. The H-21 flew the course 14 times in 11 hours, 58 minutes. Fuel consumption was about 966 gal. or 80 gal./hr.

Pilots for the run were Lt. Col. Harry L. Bush and Maj. William C. Dysinger from the Army Aviation Test Center, Ft. Rucker, Ala. The record broken by the H-21 was 778 mi., set in 1953 by a French SE 3-120 helicopter. Previous U. S. record was 621 mi.

Eisenhower Airpower Program Will Be Major Democratic Target

By Katherine Johnsen

Washington—The Democratic party is laying the groundwork to make the Eisenhower administration's military airpower program one of the leading issues in its bid to recapture the presidency.

Two former USAF secretaries will lead the attack.

The Democratic platform adopted at the Chicago convention declared:

"We reject the false Republican notion that this country can afford only a second-best defense. We stand for strong defense forces so clearly superior in modern weapons to those of any possible enemy that our armed strength will make an attack upon the free world unthinkable and, thus, be a major force for world peace."

The Republicans aggressively countered last week in San Francisco with a public defense of its policy by Aviatrix Jacqueline Cochran, a congressional candidate in California. The Republican campaign plank also contained a strong defense of the administration's military program and castigated the Democrats for lack of preparedness immediately before the Korean war.

The Republican platform defense plank reads, in part:

"Our country's defense picture is today a visible and powerful deterrent against attack by an enemy, from any quarter, at any time.

"We have the strongest striking force in the world . . .

"A jet-powered, long-range strategic air force, and a tactical air force of the

fastest and very latest type aircraft . . .

"The most effective guided and ballistic missiles.

". . . A modern Navy with a powerful naval aircraft arm . . .

"An Army whose mobility and unit fire power are without equal.

. . . "We have supported and will continue to support an effective and well-directed program of research and development."

The Democratic challenge to this will be led by Sen. Stuart Symington (D.-Mo.), first Secretary of the Air Force and chairman of the Senate Airpower Investigating Subcommittee, and Thomas K. Finletter, also a former USAF Secretary and a Democratic campaign manager.

Transportation Planks

The planks of both political parties on air transportation apparently are acceptable to both the scheduled and non-scheduled segments of the industry. They do nothing however to either promote or reject the special-interest causes urged by spokesmen for both segments in appearances before the platform drafting committees.

Despite a general stand for a "strong, efficient and financially sound" air transportation system by both parties, the industry may find itself actively injected into the political campaign through hearings before the House Anti-Monopoly Subcommittee tentatively scheduled for October.

As members of the Democratic platform committee, sub-committee chairman Rep. Emmanuel Celler (D.-N. Y.) and Sen. Joseph O'Mahoney (D.-Wyo.) fought for a plank supporting the non-scheduled airlines in their bid for "free entry" into the scheduled transportation field.

Jennings Randolph, convention delegate from West Virginia and assistant to the president of Capital Airlines, led the opposition to the Celler-O'Mahoney move and won out.

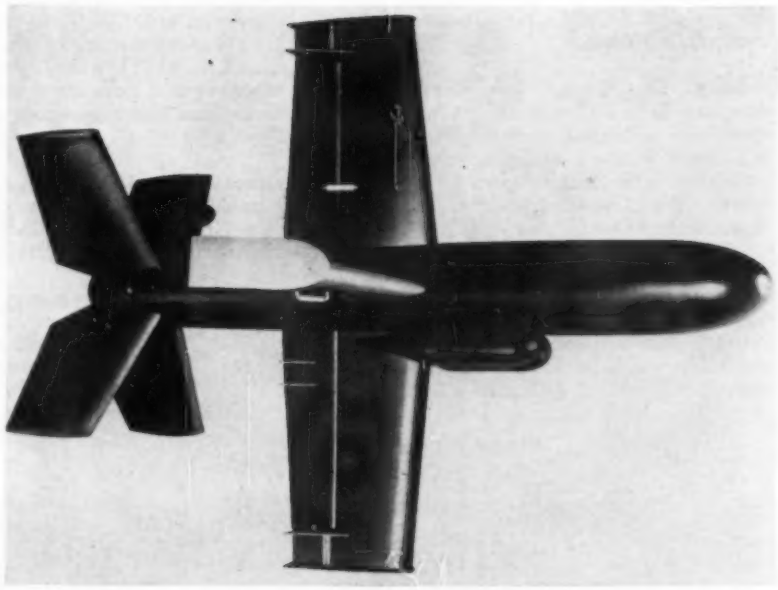
Information Policies Hit

In another field, both political platforms acknowledge the need to stimulate the training of scientific personnel. The Democratic plank also condemns the "excesses practiced" by Eisenhower administration in withholding information.

The platform pledges to reverse the trend by "substituting a rule of law for that of broad claims of executive privilege." It continues:

"During recent years, there has developed a practice on the part of federal agencies to delay and withhold information which is needed by Congress and the general public to make important decisions affecting their lives and destiny.

"We believe that this trend toward secrecy in government should be reversed and that the federal government should return to its basic tradition of exchanging and promoting the freest flow of information possible in those unclassified areas where secrets involving weapons development and bona fide national security are not involved."



Army's Dart

Dart surface-to-surface missile designed by Army Ordnance for ground combat is shown in this first, heavily retouched photo. Dart resembles in principle the German anti-tank missiles developed during World War II and guided to their targets by electrical impulses sent through trailing wires reeled out of the missile. Dart is about 6-ft. long, powered by a solid-propellant rocket. Aerophysics Development Corp., subsidiary of Studebaker-Packard, produces the missile.

Continental Can Buys Three Fairchild M-185s

Three Fairchild M-185 jet transports have been ordered by Continental Can Co. for its executive fleet.

The purchase is the first sale for the four-jet business plane and the first purchase of jet aircraft for a business fleet.

Delivery is planned for 1960. Fairchild says a mockup of the plane has been built, wind tunnel tests are scheduled for the near future and the prototype is due to fly late in 1958 or early in 1959.

The M-185 is a high-wing layout seating eight passengers and having a crew of two. Engines are four 2,000-lb. thrust Fairchild J83 turbojets, design cruise speed is 550 mph., range is 1,550 miles.

Continental Can recently ordered an F. 27 Friendship for 1958 delivery from Fairchild to bolster its current executive fleet of five piston-engined planes.

News Digest

Vertol Aircraft Corp. has been awarded a $35,000 contract for the design study of a "flying crane" helicopter for the Army. This makes a total of six manufacturers in the competition (AW Aug 20, p. 30).

Convair's reactor-carrying B-36 is officially designated NB-36H by USAF. The N stands for special test, not nuclear. Air Force previously had designation XB-36H.

Bids are asked for engineering studies for a proposed $30 million airport at Damascus, Syria. Present airport will be turned over to military use.

Kaman HOK-1 helicopter rotor downwash beat back flames on water in rescue of Ens. Howard R. Shehan, Jr., when his plane crashed on takeoff from the carrier Tarawa. It was first air-sea rescue made by HOK-1.

McDonnell F3H Demon has gone into operational service with Fighter

Squadron 124 at the Naval Air Station, Miramar, Calif., the first Pacific fleet squadron to receive the all-weather transonic interceptor.

Sabca, the Belgian firm (Societe Anonyme Belge de Constructions Aeronautiques), will make parts for French SO. 4050 Vautour under agreement concluded with Sncaso (Societe Nationale des Constructions Aeronautiques de Sud-Ouest).

German orders are in for a "substantial" number of Bristol Sycamore helicopters. Previous information indicated the German order for Bristol helicopters would total approximately 83 aircraft at a cost of $16 million (AW Aug. 20, p. 90).

Fairchild C-123 Providers and Douglas C-124 Globemasters of the Tactical Air Command will team up to airlift 21,000 lb. radomes to DEW line sites. The C-124s will move the cargo to the DEW line and the C-123s will lift the radomes to short gravel strips along the DEW line too small to accommodate C-124s.

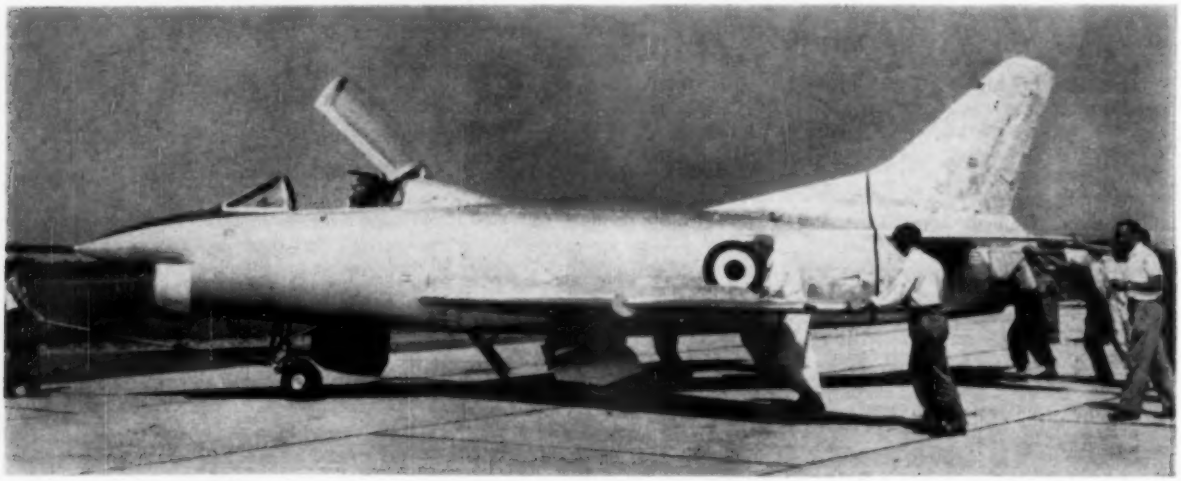
Ishikawajima Heavy Industries Co. will begin producing engine parts next April for the General Electric J47 engine model that will be manufactured in Japan.

Bristol Orpheus turbojet engine has completed 5,000 hr. of development testing, including 100 hr. flight testing. Type-tested at rating of 4,050 lb., Orpheus is running at thrust ratings greatly in excess of this figure and further increases are expected. It has flown supersonic speed in Folland Gnat.

Additional MA-1A gas turbine air compressors will be built at Toledo plant of Continental Aviation and Engineering Corp., under $7.9 million Air Force contract.

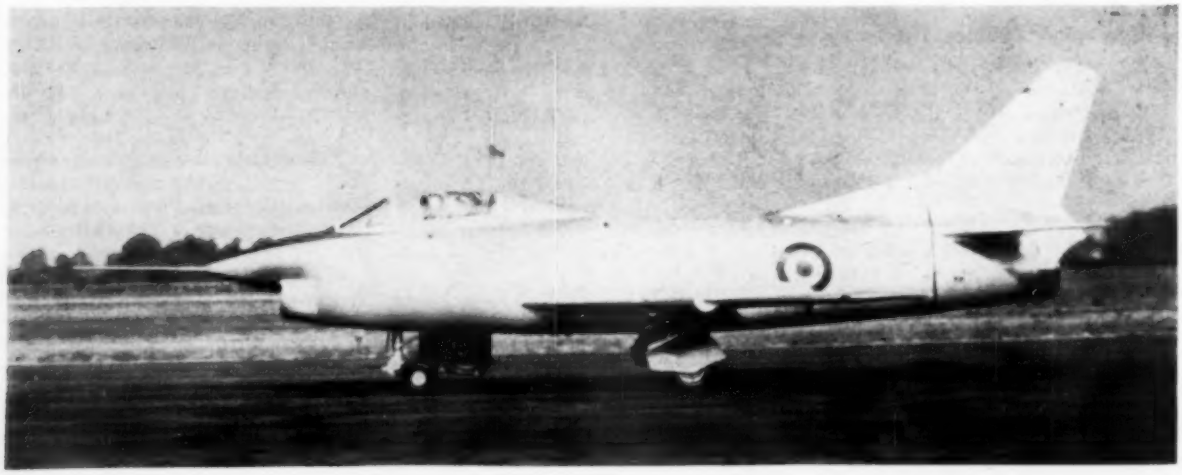
Two Canadian defense contracts call for aircraft modification kits valued at $448,000 to be built by Avro Aircraft, Ltd., Toronto, and airframe spares worth $220,307 to be built by Canadian Car and Foundry Co. Ltd., Montreal, subsidiary of A. V. Roe, Canada, Ltd.

Variable geometry diffuser and a scavenging scoop will be built by Pittsburgh-Des Moines Co., at the Arnold Engineering Development Center, Tullahoma, Tenn. Cost: $3.6 million.



Fiat G.91 Makes First Flight

Fiat G.91 tactical fighter for NATO, made its first flight recently at Turin, Italy. Designed by Giuseppi Gabrielli, the G.91 is built around the Bristol Orpheus turbojet to light-fighter principles. Small size, low construction cost and easy maintenance were the goals of the Fiat design team. First order is for 30 of the planes to be delivered for experimental evaluation by NATO. Layout shows some resemblance to North American Sabre series, a logical result of the manufacture by Fiat of F-86Ks under license from NAA.



a New 400 CYCLE MOTOR

with integral gear box for use in missiles and jet aircraft

EEMCO

technical bulletin

EEMCO Type D-899 is a compact, light weight 400 cycle, 3-phase motor with an integral gear box that operates on 200 volt power. It was designed by EEMCO especially for use in supersonic aircraft and missiles and meets MIL-M-7969-(ASG) specifications. Weighing only 11.25 pounds, it has a continuous output of 2.75 HP at 3140 RPM at the gear box. The power factor is 83% while the overall efficiency of the unit is 76%. Mounting flange is made to Spec. AND-20,000.

A feature in the design of **EEMCO Type D-899** is that the gear box acts as the motor support which places the base at approximately the center of gravity of the motor-pump assembly. This enables the unit to withstand the extreme shocks and vibrations encountered in supersonic aircraft and missiles. With minor alterations, the motor can be made splash- and drip-proof.

Type D-899 is another example of the fine craftsmanship found in all EEMCO products. EEMCO's entire effort is confined to the design and production of linear and rotary actuators and special motors of high-output light-weight ratio. Many of the latest jet aircraft and missiles being developed or delivered carry EEMCO units. EEMCO products are also used for industrial applications where precise control tolerances are imperative.

SPECIFICATIONS OF EEMCO TYPE D-899 MOTOR

Model: 200 volt, 400 cycle, 3-phase.
Load: 2.75 HP continuous output.
R.P.M.: 3140 RPM output at gear box.
Power Factor: 83%
Overall Efficiency: 76% for entire unit.
Military Specification: Meets MIL-M-7969-(ASG).
Weight: 11.25 pounds.
Comments: Type D-899 may be made splash- and drip-proof with minor alterations.

Designers and producers of motors, linear and rotary actuators... exclusively

Electrical Engineering and Manufacturing Corp.

4612 West Jefferson Boulevard
Los Angeles 16, California
Telephone: REpublic 3-0151

Anaconda specifies Enjay Butyl rubber

TO DEFY OZONE IN HIGH-VOLTAGE CABLES...

for more current per circuit...more power per dollar

Anaconda specifies Enjay Butyl insulation for high-voltage cables because this rubber has incredible resistance to ozone. Surpassing the industry's standard three-hour specification test, Enjay Butyl insulation used by Anaconda showed *no injury after 72 hours* of ozone concentration tests—24 times longer than specification requirements. Other rubbers would deteriorate and crack in a fraction of this time.

With the help of Enjay Butyl, millions of feet of Anaconda's cable now in use deliver more current per circuit, more power per dollar.

Perhaps *your* product, too, can be improved with versatile Enjay Butyl. It comes in non-staining grades for white and light-colored parts, offers excellent electrical properties, low price and *immediate availability*. For full information, contact the Enjay Company. Complete laboratory facilities and technical assistance are at your service.

ENJAY BUTYL

Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

ENJAY *Pioneer in Petrochemicals*

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.
Other offices: Akron • Boston • Chicago • Los Angeles • Tulsa

Super Sabres

North American F-100C Super Sabres of the 479th Fighter Day Wing at George AFB flash through the skies over California's San Bernardino mountains and the Owens Valley. F-100C is fighter-bomber version, can carry atomic weapons and a variety of external stores. Derived from basic F-100 series design, the C version is little different from its older brothers. It has provision for in-flight refueling, can carry external fuel and has new avionic gear for bombing. Powerplant is a Pratt & Whitney J57 turbojet rated at better than 10,000 lb. thrust.

Transport Specialists Discuss Problems

More than 500 engineers attend turbine-power meeting; Lowen says jets will fit into traffic network.

San Diego, Calif.—The third National Turbine-Powered Air Transportation Meeting of the Institute of Aeronautical Sciences pinpointed a wide variety of operational aspects and problems associated with the commercial jet era. More than 500 engineers attended the three-day sessions.

Papers given at the meeting touched on design, testing, operations and air transportation in general.

Charles J. Lowen, CAA administrator, outlined a paper on certification and operational aspects of turbine transport planning. It was delivered by W. H. Weeks, chief of CAA's aircraft engineering division.

There was reason to believe that the new jets will fit into the improved traffic control network, "which we will have operating by 1958," with a minimum of difficulty, Lowen's report said.

He added that one phase of great importance to safety is the training of pilots to fly the new jets. There is some hope that the instrumentation of the jets will be simpler than in today's aircraft, and that the new planes will be at least as easy to fly.

Because of the tremendous cost of flying the new jets for training purposes, much of the pilot training probably will be accomplished in simulators. He revealed that CAA is studying this aspect to see how much pilot training must be given through actual flight, and how much by means of realistic simulators.

Reverse Thrust Devices

Until experience is gained with reverse thrust devices, it is expected that runway lengths will be required which are adequate for stopping with brakes alone. Most of the new transports are expected to have some kind of reverse thrust device and it may be possible to eventually regard these devices as being in the same category as reversing propellers on present-day planes, Lowen said.

Maximum gross weights of the new jets will be double anything flying today in civil aviation, Lowen declared. For long-range operations, about half of the gross weight will consist of fuel. This fact, he said, puts new emphasis on the need, in case of emergency, to dump fuel safely and rapidly. The projected new jets, taking off at maximum weight, must be lightened by as much as 100,000 lb. before they can touch down at their landing weight.

Progress has been made in reducing fuel consumption through improved engine design but problems associated with traffic delays and holding at low altitudes will be more severe than with piston engine aircraft, Lowen pointed out, saying that "we may have to change our present approach to the amount of reserve fuel carried." He said that CAA is taking a hard look now to determine whether current reserve requirements are adequate for long-range piston engine operations.

Lowen revealed that CAA is working on the certification of the Boeing 707, Douglas DC-8, Convair 880, de Havilland Comet IV, and Sncase Caravelle in the jet category, and on the Lockheed Electra, Fokker F.27, Bristol Britannia, the new Vickers Viscount series, and the Vanguard 950 in the turboprop category.

J47 Experience

Emphasizing reliability and operating economy, design features of the CJ-805, commercial version of the J79 turbojet engine, were outlined in a paper presented by R. L. Carter and Neil Burgess, managers of the CJ-805 and J79 projects, respectively, for the General Electric Co.

Major experience obtained from the J47 engine and other General Electric turbojets has influenced thinking in the design of the CJ-805, it was pointed out.

Highlights of the commercial engine's makeup were divided into these major component areas:

IAS Coverage

Irving Stone and Richard Sweeney, members of the Aviation Week Los Angeles Bureau, covered the three-day meeting of the Institute of the Aeronautical Sciences on the various aspects and problems facing air transportation with the advent of turbine-power. Aviation Week's reporters digested dozens of papers submitted by experts, interviewed many, in preparing the story on these pages.

• **Front frame.** Continued use of magnesium on this component is well justified. All GE-designed engines to date have used a cast magnesium alloy for the front frame and the alloy has proven very satisfactory. Corrosion has been a minor problem, and small castings do not present a fire hazard.

Anti-icing of the inlet guide vanes and support struts, using compressor discharge air in the hollow portions of these units, will be continued in the commercial engine. Also, inlet guide vanes will be constructed of steel to withstand hailstone effects.

Mounting of accessories on the bottom of the compressor casing, instead of on the nose pad, is considered virtually mandatory for the commercial engine. This will eliminate possibility of foreign object damage and hazard of fuel or oil leaks which could enter the compressor.

• **Compressor section.** Steel construction will be used in the compressor rotor, stator blading, wheels and casings. It is felt that the steel design can be used with attractively low weight.

Shrouding only the early stages of the stator and keeping the later stages unshrouded will provide a good compromise between compressor performance requirements and resistance to severe foreign object damage.

Experience with the J47 has shown that the fabricated blade has much greater resistance than the forged blade against breaking free of the compressor casing in the event of serious foreign object damage. For this reason, this type of steel blade would be advisable for maximum safety on a commercial engine. Also, the fabricated blade costs considerably less.

The horizontal split line will also be used on the compressor casing in the commercial engine, to promote quick inspection without complete disassembly of the engine.

• **Compressor rear frame.** Because of the high pressure ratio required for a commercial engine, it is mandatory that this section be steel.

• **Combustion section.** It is felt that the individual can-type construction, as opposed to the annular type combustion system, provides reliability at lower cost and less weight.

• **Turbine section.** New materials have been developed which make it completely practical to construct turbine wheels of a single material. This makeup, it is believed, will be fully consistent with commercial requirements of

high reliability, low cost and low weight.

• **Control system.** According to GE experience, either the electronic control or the hydro-mechanical type of control system could be used, permitting selection on the basis of the requirement for the particular engine. For unaugmented engines for subsonic application, the hydro-mechanical approach is believed to represent the best answer at this time.

707 Test Experience

Flight test experience in the development of the Boeing 707 was outlined by A. M. "Tex" Johnston, chief of the company's flight test section.

During high speed flutter investigation several flights were satisfactorily made up to a comparatively high Mach number. On a subsequent flight, the previous flight maximum Mach number was exceeded by .01, and instantly severe rudder flutter was encountered with vibration sufficient to rip the flight engineer's panel from its mounting. Deceleration of the plane terminated the flutter.

This flutter mode was found to be the result of the unpredicted characteristics of a mechanical stability tab used in the directional axis, Johnston said, and the condition was remedied.

At the present time, under all load and CG conditions, the plane is flutter-free up to Mach .95, he reported.

Operational highlights of the French Caravelle jet transport were brought out in an unscheduled talk by Claude J. Teyssier, North American representative of Sncase.

The Caravelle 02, second prototype built in the series, is due to arrive in this country for a tour starting May 1, 1957, at Miami. First production Caravelle is due to fly before the end of 1957.

Teyssier revealed that flight testing with the Caravelle 01 revealed that the minimum drag coefficient is actually 8% lower than estimated up to Mach .75.

Single Engine Characteristics

Referring to the location of the jet engines on the side of the fuselage about halfway between the wing and the tail, Teyssier said that fear expressed about the plane's permissable CG travel is unfounded because the CG position can be varied between 25% to 36.5% of the mean aerodynamic chord.

Flying the twin-engine Caravelle on a single engine is like flying a single-engine plane, he said. With all tanks full, the plane can be taken off on only one engine from the usual Toulouse runway at a gross of 73,000 lb., flown and landed.

Location of the jet nacelles nine feet above the ground eliminates the danger of intaking foreign material from the runway.

Some fatigue cracks developed in the skin on the lower part of the fin. This has been remedied by conventional treatment, primarily by the installation of more stringers.

On one occasion the flaps would not retract, Teyssier said, because the tight fit of the actuator's screw did not allow for flexure of the wing. On another occasion the flight control jacks were half seized by the cold, but now they are thermostatically heated.

Teyssier reported that there has been no reaction whatsoever about noise from the public or airport attendants at or near Orly or Algiers. Climbing speed on two engines reduces to a few seconds the critical period of unavoidable annoyance.

The most striking thing Capital Airlines noticed about operating turbine powered transports is their simplicity of operation and maintenance, according to J. B. Franklin, vice president of Capital, in his paper delivered to the meeting.

Flight Crew Reaction

He said Capital's experience has been that this is the first time "progress has manifested itself in simplicity rather than added complexity, in economy rather than added expense, in reliability rather than greater sensitivity to malfunction."

He also praised the quietness of the Vicker Viscounts Capital operates, saying that "in an age where every new aircraft makes more noise and brings the outraged cries of citizen groups from miles around every airport, the Viscount marks a decided change for the better."

Flight crew reaction to the plane has been universally favorable, Franklin said, with checkouts accomplished in two weeks ground school, 10 to 15 hr. dual flight and 14 hr. observation of en route engine handling, "no more than required for upgrading from a DC-4 to a Constellation."

In maintenance, Capital has found that "you can literally maintain a Rolls-Royce Dart engine in a white shirt." Cleanliness is inherent. On the other hand, mechanics must be thoroughly checked out on turbine principles, must use watchmaker precision in cleaning and assembling Darts. In addition, experience has shown that some engine difficulties cannot be simulated on the ground, that a flight at speed and altitude are necessary, and readings on all gages recorded to indicate the nature and type of engine troubles.

In cash outlays, nine passengers pay the direct cost of a Viscount trip. With all costs included, a 50% load factor breaks even for the company, which last year had an average passenger fare of $18.49.

He said the line expects Viscount costs to remain stable, with engine overhauls increased from the present 1,400 hr. to 2,000 hr. and a slight increase in material costs for overhaul of aircraft and engines to be offset by increasing labor efficiency.

Speaking of Capital's purchase of the de Havilland Comet IV and IVA

Twin-Rotor Helicopter to BEA

Bristol 173 twin engine, twin rotor helicopter carries colors and markings of British European Airways for delivery to the line. First multi-engine helicopter to be delivered to an airline, the 173 will be given handling trials which will last several weeks. Type 173 is one of two prototypes built by Bristol to test the twin-engine tandem rotor configuration (AW July 30, p. 35). Powerplants are two 520 bhp. Alvin Leonides piston engines.

jet transports. Franklin said the decision to buy was firmed when the company analyzed all factors peculiar to its short-haul operations and delivery dates of all types of jet transports.

Franklin said Capital feels that the same experiences as were felt with the Viscount introduction into service will prevail when the Comets enter service in two years—ahead of American jets and at the same time as American-made turboprops.

Experiences in an accelerated test program to prove out certain turbine engine and propeller combinations, planned for use in operational turboprop transports now in production for the Air Force, were related by Maj. Gen. Brooke E. Allen, commander of the Continental Division of the Military Air Transport Service.

Test program began in January, 1955, with two Convair CV340s fitted with Allison YT-56-A3 engines of 3,250 hp. and Aeroproducts propellers. This engine-airframe combination is known as YC-131C. (A commercial version of the Allison engine will be used in the Lockheed Electra.)

Test Program

Operating around the clock, seven days a week, the two YC-131Cs performed "nobly" for 3,332 hr., according to Allen, and the program was completed six weeks ahead of schedule.

Engines were prototypes, initially procured as 50-hr. test articles. As a result of the test program, the time between overhaul was boosted to 200 hrs. Allen predicted that by the time the production engine gets into full operational use, the TBO should be at least 1,000 hr. The TBO of the Aeroproducts propeller, he said, was increased from an initial 150 hr. progressively to 1,000 hr. Over 6,600 flight hours were accumulated on seven Aeroproducts propellers. Experience with the props was most gratifying in every respect, according to Allen.

In September, 1955, two modified KC-97Gs retrofitted with Pratt & Whitney T-34-P5 turboprop engines and Curtiss 735 series turboelectric propellers entered the program. This engine-airframe combination is known as the YC-97J, and represented the primary engine-propeller combination planned for the Douglas C-133A, Allen said.

In March, 1956, two modified Lockheed Super-Connie C-121Cs fitted with P&W T-34-P6 engines and standard turbomatic propellers entered the testing program. This airframe-engine combination, known as the YC-121F, represented a possible alternate engine-propeller combination for the Douglas C-133.

About 12,000 flight hours have been accumulated on the T-34 engine, Allen said, and in the relatively short time of the program the time between overhaul has been advanced from an initial conservative 150 hr. to 600 hr. Four engines have been authorized to go to 750 hr. By the time the C-133A goes into operational service next year, it is expected that the TBO will go to 1,000 hr. as a result of the test program, Allen said.

Propeller Picture

On the propeller side of the picture, Allen said:

"Certainly, as we got into the 6,000 hp. engine, we expected propeller problems. We were not disappointed . . . obviously, the success of the turbine propeller powerplant depends on the concurrent development of a reliable engine and reliable propeller. With the turbine engine at its current level of dependability, a distinct challenge is offered the propeller industry to complete the cycle."

With a typical, modern turbojet engine, about 1% of the energy of the jet leaving the nozzle is converted into noise energy, which is radiated away, according to Alan Powell, Douglas Aircraft researcher on sound and fatigue.

If the total energy of the jet engine is equivalent to 10,000 hp., this means 100 hp. of noise, about equal to that of 750,000 pneumatic road drills, Powell told AVIATION WEEK.

While a good deal of theoretical work has been done on the problem of fatigue failure due to jet effluxes, the fatigue life of a structure under given conditions of engine operation is still unpredictable, Powell indicated. Much experimental work has yet to be done to provide the vital information essential to the proper assessment of fatigue failure attributable to jet exhaust effects.

There has been some experience of secondary damage of aircraft structures in the vicinity of jet exhaust, due to the fluctuating pressures caused by the jet stream. These secondary failures have not been crucial to the safety of the plane. But it is the designer's problem to insure this doesn't become crucial in the future with the addition of higher power jets with the more intense pressure fluctuations from the exhaust, Powell cautioned.

CAA Details Fiscal 1957 Plans For 26 New Long-Range Radars

Washington—Plans for expanded radar control of air traffic throughout the U. S. and the wide-spread installation of more airways facilities during Fiscal 1957 were announced last week by Civil Aeronautics Administrator Charles Lowen.

Lowen also outlined a traffic-control program for the New York area which includes closed-circuit television, multiple airways and holding areas, increased communications channels and stand-by long-range radar.

The over-all program calls for the installation of long-range radar in 26 locations throughout the country. Radar units in Norfolk should be commissioned by the end of the week and, in Chicago, no later than Nov. 30. At present, only New York and Washington are equipped with long-range radar.

Closed-circuit television, now undergoing tests, will be used to "hand-off" air traffic from New York air route traffic control center to approach control towers at LaGuardia, Idlewild and Newark. The center's six long-range screens will be telecast to the towers to provide positive identification of aircraft in switching traffic control from the center to the towers.

The expanded system in the New York area, presaging plans for other major centers, includes two and possibly three inbound Victory airways from Allentown, two inbound from Philadelphia. Congestion at the present time is concentrated on inbound airways. Radar departure control has eased the flow of outbound traffic.

Immediate plans call for dual holding areas for Idlewild and LaGuardia and one in Newark. The FPS-8 long-range radar units will be equipped with dual channels for stand-by use in case of equipment failure. Additional traffic information will be piped into the center from a Navy long-range radar at Atlantic City.

Thirteen direct communications channels will be installed in the center. Target date for completion of the system is Sept. 17. A radar room for Newark control tower is scheduled to be completed on Nov. 1 when a dual holding area will be established for Newark Airport.

Lowen said the Fiscal 1957 program will include the introduction of airport control towers at 17 airports. A total of 19 localities will receive high-intensity approach lighting, and 82 airports will be equipped with VOR.

Airport surveillance radar will be established at Miami and Colorado Springs. A new air route traffic control center at Phoenix, Arizona, will be established to cover certain areas now handled by the Albuquerque, El Paso and Los Angeles centers.

Additional frequencies for air-ground communications will be provided at 34

airports. Equipment for automatic weather broadcasting will be installed at 16 locations.

Albuquerque, Atlanta, Boston, Buffalo, Cleveland, Denver, Detroit, El Paso, Fort Worth, Houston, Indianapolis, Jacksonville, Kansas City (Mo.), Los Angeles, Memphis, Miami, New Orleans, Oakland, Phoenix, Pittsburgh, St. Louis, Salt Lake City, San Antonio, Seattle, Spokane and New York.

'Bogus' Parts Curbs Tightened by CAB

Washington—Alarmed by the increasing use of "bogus" (uninspected) airplane parts and the resultant threat to air safety, the Civil Aeronautics Administration has renewed its efforts to curb their manufacture and distribution.

A CAA spokesman said some 125 manufacturers have failed to comply with a Civil Air Regulation adopted in August, 1955, to stem the flow of second-rate parts. To offset this noncompliance, it has issued an Aviation Safety Release designed to reinforce present restrictions by penalizing the purchasers and/or users of the parts.

The new release rules that the installation of unapproved parts "may be grounds for suspension, revocation or denial of air-worthiness certificates." It adds that, if a replacement or modification part is not identified and is installed in an aircraft, the plane is not eligible for an airworthiness certificate until each part is substantiated by the owner or installer.

The original regulation requires a system for the approval, identification and inspection of parts that are "fabricated by persons, other than the prime manufacturer" and sold through normal trade channels.

While about 25 of the 125 manufacturers have established inspection systems approved by the CAA, the agency is still working with a large number of manufacturers who have yet to establish authorized inspection procedures.

To protect aircraft operators, the release includes four guides as an aid in determining whether parts are approved. They are:

- **Parts produced by** the prime manufacturer without an inspection system will carry Approval Tag, Form ACA 186, until an inspection system is approved.

Thereafter, the manufacturer's shipping ticket or invoice will serve as evidence that parts are approved.

- **Parts produced by manufacturers** other than the holder of basic type design will be earmarked with an Approval Tag. Upon the establishment of an approved inspection system, parts will be stamped with the symbol CAA-PMA in lieu of the Approval Tag.

CAB Approves Fares Tentatively

Washington—New North Atlantic fares proposed by the world airlines at the International Air Transport Assn.'s Cannes conference have received the reluctant, tentative approval of the Civil Aeronautics Board.

The CAB approved the new first-class and tourist fares for a year from the date they go into effect, but it also proposed discussions on fare policy with other governments directly concerned with North Atlantic fares.

The Board said fare discussions on the governmental level are needed to promote mutual understanding on international rate-making policy. The discussions would be aimed towards establishing a basis on which IATA airlines would be able to reach agreements that would help eliminate North Atlantic fare problems.

The CAB strongly recommended that discussions be held in time to allow reconsideration of the North Atlantic fare structure before the 1957 summer season begins. Its approval of the new IATA fares is subject to review after the proposed discussions.

The North Atlantic fare problem came to a head early this year when the CAB set a Sept. 30 limit on its approval of the North Atlantic fare structure. IATA carriers called an emergency traffic meeting in Cannes at the end of May to find a fare formula that the CAB would approve beyond September.

Before the meeting, CAB told the carriers it favored, among other things, higher seating densities and lower fares in tourist service, cancellation of a 10% increase in first-class fares and application of subcharges for sleeper seat accommodations.

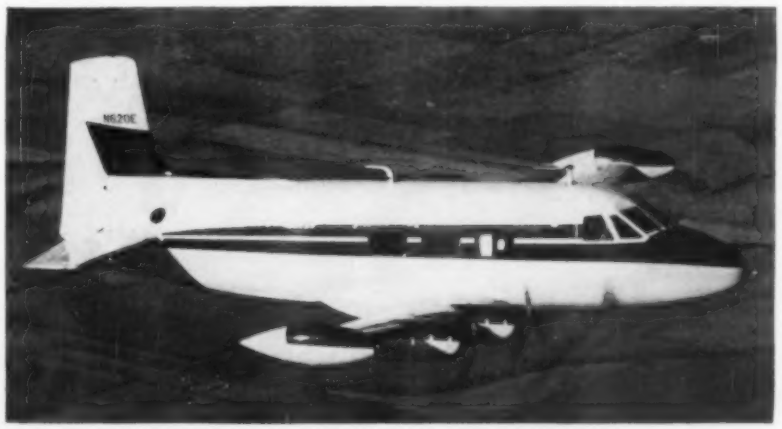
After a month of often-bitter negotiations, the IATA carriers agreed on a new fare structure for the North Atlantic, a compromise between CAB proposals and old fares (AW July 2, p. 37).

Basic changes were a new 15-day excursion fare effective October 1; a new third-class, low-fare service effective April 1, 1958; establishment of extra charges for sleeper seats, and cancellation of the 10% first-class fare increase on April 1, 1957.

The CAB views the new fares with mixed emotions. The proposal to inaugurate a third-class service in 1958 is approved by the Board because it is based on higher seating density and lower fares without damage to the overall level of airline revenues.

The CAB criticized the carriers for not revising seating standards and fare levels for tourist service in the 18-month period before a third-class service is inaugurated, especially "in the light of the increase in the overall level of revenues which it is expected will result from the elimination of both first-class and tourist class off-season discounts."

Previous CAB opinion that a 15-day excursion fare is no answer to the problem was repeated, and the Board said: "This failure to accomplish any immediate revision in the tourist class fare structure, as an initial step toward realization of the type of service agreed to be introduced April 1, 1958, indicates a fundamental deficiency which, if not resolved, may restrict unnecessarily the proper development of the North Atlantic travel market."



Cessna Starts 620 Flight Tests

Intensive flight test program on new Cessna four-engine pressurized business transport began recently at Wichita, Kan. Model 620 is powered by four 320-hp. Continental GS0526-A engines. The circular exit just above the horizontal stabilizer is the exhaust for the plane's AiResearch gas turbine cabin pressurization unit. Cessna plans to announce production plans, delivery dates and official price for the 620 on or about Oct. 1.

PRESENT Northeast Airlines fleet of Convair 240s (above), DC-3s and two leased aircraft won't help much in competing for Florida traffic under the airline's new route award. DC-6B deliveries will begin next year, however, and Northeast meanwhile will fill the gap by leasing more and bigger planes.

Northeast, Leasing to Fill Gap, Predicts End of Subsidy in Year

By Glenn Garrison

Boston—Northeast Airlines hopes to begin operating to Florida late this year or early in 1957, and expects to become subsidy-free after a full year on its new, lush route. The carrier recently became the third airline in the Miami market when Civil Aeronautics Board decided the New York-Florida Case (AW Aug. 20, p. 38).

Leased equipment will fill the gap until Northeast's DC-6Bs are delivered, the airline's president, George E. Gardner, told AVIATION WEEK. Negotiations are under way for leasing five planes from other airlines, either DC-6Bs or 749 Constellations.

Three of Northeast's present order of ten of the Douglas aircraft will be delivered by next March, the others during June through September, Gardner said. He thinks the DC-6Bs will compete effectively with the DC-7's and Super Constellations of Eastern Air Lines and National Airlines, despite the speed differential. Furthermore, the DC-6Bs can operate into some Northeast stations where the DC-7s could not—LaGuardia, for example.

Additional two DC-6Bs probably will be ordered from Douglas in the near future, Gardner said, for use in Philadelphia and Baltimore service.

The Northeast president isn't worried about prospects of being a late starter with jetliner service in the Miami market, either. He believes delivery dates of jet equipment which Northeast will order are likely to be so close behind the introduction of Eastern's and National's jets that no long-range competitive disadvantage will ensue.

On this basis, Gardner said, Northeast waited until "we could be sure we had this run before we committed ourselves" to jet orders.

Financial provisions have been made, according to Gardner, for down payment on five jets to put Northeast in the market by 1960. No decision has been made as to whose jets Northeast will buy, but Gardner inclines toward the smaller aircraft such as the Convair 880 or Douglas DC-9 for the Florida route.

Northeast also has looked at British aircraft, Gardner said, and might be interested in the Comet IV "if we got a good deal."

The airline's tentative timetable of operations over its new routes calls for New England-Washington service around Nov. 15 with the schedules overflying New York. Philadelphia and Baltimore will be tied in with this service later. The first Miami schedules, expected sometime between Dec. 1 and Feb. 1, will serve Boston, and New York-Miami service will follow.

When service to Tampa and Jacksonville is established, the flights will turn around at Tampa.

New York-Washington service, and additional schedules from New England points, will round out the pattern of Northeast's new services.

Moving into the big league will mean great facilities and personnel ex-

SMITH CW-20T modified C-46 serves Northeast Airlines on Boston-Burlington-Montreal run. Northeast leases the 40-passenger CW-20T from L. B. Smith Aircraft Corporation of Miami, may acquire several more of the planes under similar agreement.

pansion for Northeast. The airline's maintenance base at Boston will be doubled in size. LaGuardia facilities will be expanded, a turnaround setup established at Tampa, and discussion is already under way with the Port of New York Authority for possible construction of a hangar at Idlewild or Newark.

At Miami, according to Gardner, Northeast may be "crowded into the existing terminal" or temporarily assigned to the non-scheduled airline area at that airport. A Northeast team will go out in a few days to firm up arrangements at the new stations.

Under the planned setup, Northeast's reservations services will be concentrated at New York. Seasonal turnover of personnel will be avoided by this move, Gardner feels. Northeast's present traffic is heavy in the summer season, when New England spots are popular, whereas the new route will produce most traffic in winter for the Florida trade.

This balancing of the seasonal aspects of Northeast's business is expected to benefit the airline greatly. At present, seasonal layoffs of pilots, stewardesses and other personnel are heavy.

The expansion will double the airline's present peak personnel force of 1,200, Gardner estimates.

Northeast probably will operate more coach service on the New York-Florida run than previously planned.

Instead of coach flights at night only during the Florida season, daytime schedules may be split 50-50 between coach and first class accommodations.

Northeast officials know nothing about the sudden rise in the airline's stock which preceded announcement of the New York-Florida decision of the Civil Aeronautics Board, Gardner said. Expressing the hope that "there's no way we can be discredited" by a Securities Exchange Commission investigation, Gardner called Northeast an innocent bystander.

He approved the new CAB policy of announcing decisions as they are made to avoid leakage.

SEC started an investigation of transactions of Northeast airlines stock as soon as it saw the unusual activity in the airline's shares which started August 3.

CAB voted Aug. 10 to ask the SEC to look into the Northeast stock situation, but SEC was already at work on it, trying to determine whether there was any market manipulation involved when Northeast stock rose several points after news of the New York-Florida route award leaked out.

It will be several months before SEC finds out whether there were any irregularities in trading of Northeast stock on Aug. 3 or after.

The heavy financing needed for Northeast's expansion program has been arranged, according to the Atlas Corp., which owns 50.97% of the airline stock.

Northeast's present fleet consists of 12 DC-3s, six Convair 240's, a leased DC-4 and a leased C-46 conversion.

The conversion, a Smith CW-20T, went into service this month as a scheduled airline aircraft for the first time on Northeast's Boston-Burlington-Montreal route. Non-pressurized, the CW-20T seats 40, compares with the Convair 240 in performance, according to Gardner. The plane requires a longer runway than the Convair, however, and cannot serve some Northeast stations.

Britannia Begins Tour of Continent

San Diego—For the first time in history a British airliner has made a nonstop transcontinental crossing of the United States. Bearing over a ton of sales literature for U. S. airline operators, the Bristol Britannia 102 turboprop made the crossing at an average true air speed of 307 kts. (353 mph.) at an altitude of 20,000 ft.

A team of 45 Bristol engineers, executives and sales people headed by Managing Director Peter Gordon Masefield is making a swing around this continent to hit potential buyers where they live. Riders in the Britannia, billed as the "Whispering Giant," are the keypoint of the Bristol sales pitch. In the first meeting for press and airline representatives in New York, Masefield said:

"We are here to show you the actual ironmongery. You can see it, you can feel it and you can ride in it. It is not a piece of paper."

The transcontinental crossing was made from New York to San Diego in just over eight hours. Time was lost in altering course around some weather over the Rocky Mountains. The average true air speed of 307 kts. would have been somewhat higher but for the fact that the flight began at the maximum take-off gross weight of 155,000 lb. Speeds in excess of 400 mph. are claimed for the airplane.

The plane was piloted during the crossing by a British Overseas Airways Corporation crew headed by Capt. Albert Meagher. Capt. Wilmer Reedholm, eastern assistant superintendent-flying operations of American Airlines, rode in front to check the British crew out on United States traffic procedures.

The BOAC crew is handling all the point-to-point flying on an itinerary that includes New York, San Diego, Los Angeles, Vancouver, San Francisco, Denver, Miami, Ottawa and Montreal. Demonstration flights are being handled by a Bristol crew headed by Captain A. J. Pegg, chief test pilot.

CAB Approves Initial No-Show Plan Phase

Initial phase of the airlines' effort to solve the no-show problem has been approved by the Civil Aeronautics Board. However, approval of the second phase, which involves economic penalties, was withheld until the airlines definitely decide to use it.

The Air Traffic Conference of America reached agreement on a set of regulations designed to cure airline reservation and ticketing problems at a meeting earlier this year (AW July 9, p. 38). The agreement was reached after more than a year of study and argument over the best method of solving the increasingly serious no-show problem.

The ATC plan is scheduled to go into operation in two steps. The first phase, effective September 16, sets time limits within which a passenger must pick up his ticket or have his reservation canceled.

This phase has been approved by the CAB.

The second part of the program involves economic penalties. It establishes service charges for late cancellations and penalties for no-shows. ATC will vote sometime between Dec. 16 and Feb. 1 to decide whether the penalty system is still needed and whether it should go into effect on February 1. The CAB will withhold its approval of the plan until these decisions are made.

Local-Airline Pattern To Get CAB Review

Washington—Civil Aeronautics Board will launch a series of local air service area cases within the next year to completely review the local-airline service pattern in the U. S.

The CAB will review the local airline pattern through a series of route cases that will study service in the Northeastern state area, the Southeastern area, the Southwestern area and the Kansas-Oklahoma area.

Each area case will include applications for new service in the states involved that have been filed by various airlines and communities.

In addition to the proposed cases, the CAB has three sectional investigations already under way. In the Seven States Area Investigation, the Board is studying local air service in North Dakota, South Dakota, Nebraska, Illinois, Minnesota, Wisconsin and Iowa.

The Pacific Northwest Local Service Investigation includes service in Washington, Oregon, Idaho and Montana; the Great Lakes Area case covers service to points in states around the Great Lakes.

THREE-AXIS FLIGHT SIMULATOR

Providing a flight table which can be continuously oriented in space with respect to 3 mutually-perpendicular reference axes, the CTI Three-Axis Flight Simulator can be programmed directly from the output of a computer. Operating smoothly with no gearing, the instrument accepts independent voltage signals in each of the 3 axes and converts these analogs into a position corresponding to the defined space vector.

By thus reproducing the conditions of an actual high-performance aircraft or missile in flight, the unit expands the capabilities of any testing laboratory. Write for your copy of the descriptive brochure.

SPECIFICATIONS

Roll Acceleration, approx max	40,000 deg/sec^2
Pitch Acceleration, approx max	20,000 deg/sec^2
Yaw Acceleration, approx max	8,000 deg/sec^2
Roll Velocity, approx max	250 deg/sec
Pitch Velocity, approx max	150 deg/sec
Yaw Velocity, approx max	125 deg/sec
Roll Displacement, max	±120 deg
Pitch and Yaw Displacements, max	±90 deg
Signal Sensitivity	1.8 deg/volt
Linearity	0.1 %
Servo Accuracy	±0.5 deg
Inertia Load Limit for Flight Table	3 lb-in.-sec^2
Equipment Test Volume, cylindrical	17-in. diam by 13 in.

CTI®

COLOR TELEVISION INCORPORATED
SAN CARLOS 6, CALIFORNIA

Two New Routes Awarded to Central

Washington—Central Airlines received new Denver-Oklahoma City and Amarillo-Wichita routes in the Civil Aeronautics Board decision on the Liberal Service Case.

The ruling gave Central these two routes for a three-year trial period:

- **Denver to Oklahoma City** via Colorado Springs and Lamar, Colo.; Guymon, Okla.; Liberal, Kan., and Enid, Okla.
- **Amarillo, Texas, to Wichita, Kan.,** via Borger, Texas; Guymon, Okla., and Liberal, Kan.

Central was chosen over Frontier Airlines for the Denver-Oklahoma City route because the route fits into Central's system better and because the cost of subsidy support for Frontier's proposed service would be higher. The CAB decided to let Central experiment with the route on the basis of one round trip a day.

The Board estimated that the airline's break-even need for the new services would be close to $200,000 and said increase in subsidy is justified by the area's need for local air service.

A second factor in the CAB's decision to chose Central for the route was the fact that the airline carries less passenger traffic than any other local airline. The Board said the new routes will strengthen the carrier's system and bring it more into line with the systems of other local service carriers.

Shortlines

► **Air France** has added a third weekly service between Paris and Tokyo via Frankfurt. Prague also has been added to the airline's Paris-Hong Kong service.

► **Trans World Airlines,** United Air Lines and American Airlines have asked the Civil Aeronautics Board for permission to continue using the $80 transcontinental excursion fare. Present authority expires next month. TWA says its coast-to-coast tourist traffic increased 55% in the second quarter of 1956 as compared with the same 1955 period and that a large share of the increase can be credited to the $80 fare.

► **Braniff Airways** will call its new DC-7C the El Dorado and place the equipment in service on Oct. 20 over its Texas-New York route. The El Dorado will have Bendix airborne radar and will be operated in combination class with seats for 28 first-class and 45 tourist passengers.

► **British Overseas Airways Corp.** added a twelfth weekly flight to West Africa

AIRLINE OBSERVER

► First flight of the Douglas DC-8 jet transport is scheduled for March, 1958. Certification date is projected for October 1959 but Douglas will try to advance the date to August of that year.

► **National Airlines schedule was thrown into confusion, as a result of a threatened strike by company pilots that had been scheduled for August 17. Although the pilots failed to follow through on the announced action, National already had furloughed employes and slowed operations to a virtual standstill. Flights were gradually reinstated during the following five days, and operations were scheduled to return to normal by late last week. Only the Capital-National interchange and the New York-Norfolk shuttles operated on an uninterrupted basis during the Aug. 17-Aug. 23 period.**

► General Electric's CJ-805, commercial version of the company's J79 turbojet engine, will carry a price tag of $125,000. Engine will power Convair's 880 Golden Arrow transport.

► **Capital Airlines has replaced its mobile electric starters at Pittsburgh with underground cable units drawing on terminal-building power sources. The Lincoln starting units for Capital Viscounts contain a 1,500 amp. generator that produces 31 volts through a 150-ft. cable laid beneath the ramp. Three units are in operation at the Greater Pittsburgh Airport. The airline also plans to make the switch at other major airports.**

► Boeing's 707 jet transport prototype will begin flight testing an early-model thrust reverser in October. The tests will collect data for integration into the design of production model reversers.

► **Civil Aeronautics Board this week is resuming its investigation of the United Air Lines DC-4 accident at Medicine Bow, Wyo., last October. Investigators A. B. Hallman and Frank Taylor have returned to the accident scene to finish the investigation that had to be suspended last November because of snow and ice in the area.**

► American Airlines has raised its retirement age for employes under a new pension plan. The program has set 68 as the normal retirement age; retirement at 70 is mandatory. Previously, the retirement age for males was set at 65; for females at 60.

► **International Civil Aviation Organization is studying air-traffic-control services at Southwest Asia airports during a ten-day conference in Bangkok. Under discussion are plans to implement airport control systems that will conform with procedures adopted by the ICAO Air Navigation Conference at Melbourne in 1953.**

► Survey conducted by Pan American-Grace Airways shows that airport redesigning or runway extension to meet jet requirements are under way at South American airports in Quito and Guayaquil, Ecuador; Cali, Colombia; Talara, Peru, and Santiago, Chile.

► **Scheduled airlines lack of interest in previous cases has led the Civil Aeronautics Board to ease procedural requirements for small Canadian carriers applying for foreign air-carrier permits to operate casual, occasional and infrequent service with small aircraft across the Canadian-U. S. and Canadian-Alaskan borders.**

► Jet transports now under design will be fitted with conventional 65-lb. flares in accordance with Civil Air Regulations. The last flare drop in U. S. transport operations was made in January, 1947, when two were used by a DC-3 in landing.

► **Navigation Panel of Air Coordinating Committee has completed its studies of the Tacan/VOR-DME dispute to meet its deadline date of August 20. Nav Panel's report, together with its recommendations for a common airways system, now goes to top-level ACC officials where a final decision on the long-debated issue will be made. New target date for a decision is Thursday.**

Airline Traffic — Second Quarter 1956

	Revenue Passengers	Revenue Passenger Miles (000)	Load Factor	U. S. Mail	Express	Freight	Total Revenue Ton-Miles	Per Cent Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American	2,081,235	1,266,988	72.84	4,883,120	2,366,772	15,825,523	144,895,527	61.87
Braniff	462,341	186,792	63.49	649,361	373,346	1,065,946	19,986,832	56.03
Capital	774,957	263,298	63.85	757,795	535,002	837,717	27,314,126	47.81
Continental	179,123	64,764	53.01	211,362	78,989	326,725	6,830,868	46.03
Delta	619,929	293,261	64.64	951,833	719,109	1,786,459	31,681,387	59.01
Eastern	1,925,009	967,673	63.86	2,667,959	1,174,086	3,232,100	106,113,094	50.27
National	348,220	240,677	71.02	745,783	156,440	1,202,443	26,696,433	69.25
Northeast	150,520	30,140	60.54	32,681	46,335	84,133	2,909,566	58.20
Northwest	351,520	231,487	62.75	1,107,248	589,076	1,830,033	26,340,537	54.02
Trans World	1,084,816	835,893	68.93	2,898,104	1,885,968	5,321,924	90,133,283	62.03
United	1,637,672	1,134,911	68.83	6,590,318	2,855,408	11,279,204	129,778,637	59.86
Western	269,349	129,487	63.61	615,162	221,272	488,806	13,700,718	59.48
INTERNATIONAL								
American	31,868	21,444	63.43	33,311	1,485	837,753	3,089,538	66.06
Braniff	7,669	16,586	47.63	49,942	.....	224,585	2,148,829	51.64
Caribbean Atlantic	43,218	3,174	55.79	3,407	.....	6,960	297,120	53.03
Delta	13,685	15,885	59.52	19,884	.....	127,947	1,787,810	47.24
Eastern	60,145	81,295	62.69	177,412	.....	217,202	9,083,864	56.36
National	27,209	15,386	54.51	25,980	12,055	84,544	1,710,210	53.22
Northwest	31,104	59,134	60.20	2,673,708	54,305	2,589,447	11,811,078	69.16
Pan American								
Alaska	22,271	26,905	69.99	120,983	.....	1,122,800	4,067,091	58.01
Atlantic	271,093	324,241	64.35	2,734,661	.....	5,430,857	41,976,571	61.71
Pacific	74,515	220,699	75.48	3,220,844	.....	4,025,218	30,495,527	71.17
Latin American	289,950	270,777	62.03	1,039,667	.....	9,073,934	36,068,971	58.93
Panagra	35,442	40,570	56.97	155,493	.....	944,443	5,473,507	56.98
Trans World	79,861	200,492	64.86	2,308,195	.....	2,226,853	25,619,135	70.45
United	27,639	68,604	74.60	331,939	.....	201,621	7,608,587	68.91
LOCAL SERVICE								
Allegheny	109,750	18,141	46.40	20,642	52,518	14,067	1,817,598	47.10
Bonanza	34,852	7,575	45.27	11,980	6,796	18,301	754,224	43.41
Central	32,007	5,304	36.26	11,640	6,295	16,455	541,381	32.38
Frontier	48,653	12,932	47.95	48,740	23,163	174,914	1,482,676	57.70
Lake Central	37,394	5,726	41.54	6,435	31,300	.....	559,904	39.64
Mohawk	96,618	17,381	57.80	16,691	24,727	30,520	1,729,747	57.50
North Central	145,860	22,880	56.77	56,133	83,194	.....	2,320,305	50.70
Ozark	84,289	12,938	39.03	28,870	46,738	19,385	1,305,155	39.03
Piedmont	111,159	21,075	57.37	41,394	34,153	36,297	2,128,944	56.89
Southern	48,998	8,529	47.11	25,828	36,649	.....	879,299	44.84
Southwest	72,352	13,976	47.46	23,446	13,283	23,328	1,390,660	46.08
Trans Texas	55,800	12,605	40.17	39,197	27,167	54,504	1,323,182	36.89
West Coast	58,400	10,225	49.06	11,978	6,281	16,220	965,778	52.46
HAWAIIAN								
Hawaiian	116,606	16,899	64.84	13,594	.....	334,400	1,843,540	58.08
Trans Pacific	54,546	6,876	52.59	2,155	.....	28,959	557,516	50.87
CARGO LINES								
Aerovias Sud Americana	.....	.....	.....	.....	.....	1,879,727	1,879,727	62.60
Flying Tiger	14,521	55,080	98.86	85,928	29,893	17,070,823	22,694,781	72.32
Slick	.....	.....	.....	.....	.....	.....	.....	.....
Riddle	.....	.....	.....	.....	.....	.....	.....	.....
Seaboard & Western	.....	.....	.....	.....	.....	.....	.....	.....
HELICOPTER								
New York Airways	11,061	208	60.47	2,973	3,879	1,690	27,814	64.06
Los Angeles Airways	.....	.....	.....	.....	.....	.....	.....	.....
Helicopter Air Service	.....	.....	.....	7,770	.....	.....	7,770	43.19
ALASKA								
Alaska Airlines	14,451	5,992	31.85	119,244	.....	1,639,228	2,442,425	46.78
Alaska Coast	.....	.....	.....	.....	.....	.....	.....	.....
Byers Airways	638	75	34.56	1,894	.....	2,961	12,813	77.58
Cordova	4,440	775	43.22	8,084	.....	441,973	529,385	55.69
Ellis Air Lines	16,185	840	51.12	6,021	.....	9,235	100,648	60.63
Northern Consolidated	4,949	1,667	46.16	61,121	908	1,358,778	1,603,719	84.96
Pacific Northern	33,620	26,628	60.27	211,780	.....	832,919	3,916,105	67.77
Reeve Aleutian	.....	.....	.....	.....	.....	.....	.....	.....
Wien Alaska	8,218	3,679	16.16	106,102	.....	3,384,283	3,864,911	94.33

*Not available.
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

last week with a London-Lagos service. The BOAC London-Dar-es-Salaam service has been converted from Argonaut to Constellation equipment.

▶ **Canadian Pacific Airlines** has ordered four DC-6B transports for delivery in 1957. The $6 million order includes weather radar equipment. Delivery of the four aircraft will bring CPA's fleet to 12 DC-6Bs.

▶ **Czechoslovak Air Lines** reports that it flew 2,365,108 miles during the first half of 1956, 1,099,602 of them on domestic routes. The Czech airline hopes to start service on Prague-Brussels and Prague-Zurich routes this year.

▶ **Los Angeles International** Airport handled 393,901 passengers in June. International traffic at Los Angeles showed a 35.8% increase during the month and a 22.4% increase over the first six months of the year.

▶ **Lufthansa**, the German airline, has received its seventh and last Super-G Constellation from Lockheed, but the German carrier still has four 1649 Super Star Constellations on order for 1958 delivery. Lufthansa started its first South American service this month with two weekly flights to Rio de Janeiro, Sao Paulo and Buenos Aires via Dakar. Next month, the carrier will start a Super-G Constellation service to Istanbul, Beirut, Baghdad and Teheran.

▶ **National Airlines** has added a second Convair 440 Metropolitan flight between Miami and Havana.

▶ **Ozark Air Lines** has leased the south wing of St. Louis' old administration building at Lambert Field to provide 7,500 sq. ft. of extra space for the airline's maintenance base and general offices.

▶ **Panagra's** cargo traffic between the U. S. and South America showed a 45% increase in the first half of 1956 over that of the same period of last year.

▶ **Southern Airways** flew 106,000 passengers 18,250,000 passenger-miles during the first seven months of the year, increases of 9.5% and 14% respectively over traffic for the same 1955 period. In July, the carrier flew 15,500 passengers 6,290,000 passenger-miles.

▶ **Swissair** will add a second weekly DC-4 all-cargo flight between New York and Zurich in October. Swissair flew 3,349,918 ton-miles of cargo in the first six months of 1956, an increase of 43% over the same period last year. Cargo capacity increased 13% during the same period.

COCKPIT VIEWPOINT

By Capt. R. C. Robson

And Mix Well

Take any metropolitan area. Reduce visibility to three miles, add several aircraft on instrument flight plans, allow several more to "maintain 1,000 feet on top," and let the balance fly VFR. Speed ranges of the aircraft should vary from helicopters, through light planes, up to jets. Communications should be handled mainly on one frequency but several can be used. Now mix well.

Most everyone will recognize this conglomeration as the standard operating procedure in use today as well as a grand recipe for trouble. We have vehicles of widely varying speeds with a variety of radio equipment, half of them flying under controlled conditions, their whereabouts known, while the other half fly helter-skelter, and the radio frequencies are so crowded that orderly reports are impossible.

First Day Worst

It is a paradox that bad as present traffic control is, the safest flying conditions occur when all aircraft are actually operating on instruments. The first day of a spell of bad weather in air traffic usually is horrible, since many aircraft either unequipped or unprepared for instrument flight will be in the air. Once these are weeded out by successive days of bad weather, those left have a relatively easy time of it. By eliminating the variables and the unknowns traffic can move in an orderly fashion, albeit slowly, in a cumbersome manner, and in reduced numbers.

The hazards of a mixture of VFR and IFR traffic are nicely illustrated by a common occurrence at all terminals. An aircraft making an instrument approach reports to the approach controller. Not until passing the outer marker on final does the pilot change to tower frequency. And not until this point does the pilot learn that he is about number three to land behind VFR traffic that has already circled in from another direction. Now what happens?

Should the pilot reverse course into the face of the next ship making an instrument approach, or should he continue on course? What about that VFR traffic he can't see? And there you are.

Planes Hard to Spot

It is sometimes puzzling to a non-flyer to hear that it is not possible to spot other aircraft in the air with ease. Standing on the ramp of the airport a Connie or DC-7 appears so large that it seems inconceivable that it could escape air detection. But a view from a hundred feet away is vastly different than one from a few miles (a distance easily traversed in a few seconds). Experiments have proved that even when a pilot is looking for known traffic he can find it less than half the time. Since the perspective of an aircraft on a collision course does not change for the viewer the target appears to stand still. And aircraft have a very nasty habit of remaining behind a windshield mounted compass or other such obstacle until it is nearly too late.

Under present regulations controllers have very little to say in the matter of when instrument conditions prevail. For many good reasons pilots have considerable latitude in deciding for themselves whether to operate controlled, or VFR or on top.

But this decision obviously can vary widely with the individual and is at times overdone. While we cannot legislate safety it does seem that higher minimums for VFR flying, speed restrictions in terminal areas (within a radius of at least 25 miles) and 100% controlled flying in these areas are things that are needed now.

Russian Engineering Education, Part 2:

Ivan Petrovich Studies 55 Hours a Week

By Leon Trilling*

Having considered the wide range of subjects taught at Soviet aeronautical institutes, we can now follow a hypothetical student, Ivan Petrovich Popov, through his course at the Faculty of Aircraft Design of the Ordzhonikidze Moscow Aeronautical Institute.

Ivan Petrovich is the son of a research engineer at Central Aero and Hydrodynamic Institute (TsAGI) who holds a minor position in the wind-tunnel department. The old man, Piotr Ivanovich, comes from peasant stock and is the first of his family to have an education and to hold a clean job, for which opportunity he is grateful to the Communist Revolution. His education, acquired in the late 1920's and early 1930's, is spotty; and Piotr Ivanovich, having lived through many purges, has learned that safety lies in doing no more than necessary and in attracting as little attention as possible. Consequently, he has not attempted to participate in any of the graduate adult education schemes, which might have brought him both a promotion and too much responsibility, and he is not a member of the Communist party.

While the Popovs live in moderate comfort, they do not enjoy some of the extra luxuries available to the youngish, pushy Jewish section leader in the house next door who has just received a large raise upon obtaining his *Kandidat* degree from the Correspondence Department of the Ordzhonikidze Institute.

This psychological attitude, both the lack of drive among engineers of middle years and a definite resentment at the ambition and success of the relatively numerous Jewish engineers, was mentioned by most of the observers interviewed who had spent several years in the USSR after the war and had had continuing contact with Soviet engineers. Their circle of acquaintances was too wide and too scattered to classify this as a local disturbance and it has therefore been woven into the discussion. There is also a good deal of evidence of a tendency for children to make their careers in their fathers' fields.

No Tuition

Young Ivan Petrovich finished the ten-year school with a gold medal, and, with the little additional push of a good word from his father's department chief, who is also a professor at the Ordzhonikidze Institute, he was admitted to the Institute without entrance examination—although only one out of twelve applicants is accepted. He has been awarded a stipend of 400 rubles per month, and, since his father is employed in the air ministry, Ivan Petrovich pays no tuition.

Introduction to Courses

In his first year of study Ivan takes courses in Marxism-Leninism and one foreign language (French, German, or English); some introductory courses on aeronautics, both lectures and laboratories; and the inevitable drafting courses which all apprentice engineers must go through all over the world. The main portion of his time, however, is devoted to the basic science courses: college mathematics (analytic geometry, differential calculus), general chemistry, and physics (mechanics and elementary theory of heat).

The chemistry and physics courses consist of lectures three times a week, one recitation period in which the students divided into groups of twenty or so solve problems and go over the sticky points of the course with a graduate assistant or docent, and a laboratory period in which they perform experiments set up for them in the well-equipped laboratories of the Institute. The math course consists of four lecture hours and two seminar (or problem) sessions per week.

(The standard mathematics textbook in the 1930's was *Calculus* by Smith, Salkover and Gustice, also a standard text in many American schools [including the California Institute of Technology]. During the 1940's V. I. Smirnov wrote a five-volume course in higher mathematics which is now the accepted textbook in the Soviet Union. The first two volumes, which cover calculus and differential equations, have been printed in several hundred thousand copies and are used in all science courses in universities and in technical institutes during the first two years. The last three volumes, of which 10,000 to 25,000 copies were printed, are used by mathematics departments in universities. The textbook itself is an example of excellent presentation of the subject matter.)

Altogether, this first-year course is essentially the same as the freshman course in an American institute of

Curricula: MAI vs. MIT

Per cent distribution of time allotted to different courses comprising curricula in aircraft design at the Moscow Aeronautical Institute (MAI) and the Massachusetts Institute of Technology (MIT), 1955-1956.

Type of Courses	Per Cent of Total Time			
	At MAI		At MIT	
SERVICE COURSES		38.0		44.0
Humanities	11.0		11.3	
Basic Sciences	17.7		25.3	
Physical Education	1.4		2.4	
Drafting	2.7		2.4	
Introduction to Aeronautics	5.2		2.6	
MAJOR TECHNICAL COURSES		35.1		39.5
Aerodynamics and Control	25.8		27.4	
Design and Structures	9.3		12.1	
MINOR TECHNICAL COURSE		26.9		16.5
Control Devices	7.4		9.3	
Propulsion	6.0		3.6	
Auxiliary Equipment	5.8		2.0	
Production Techniques	7.7		1.6	
TOTAL	100.0	100.0	100.0	100.0
Proportion of Contact Hours	53.4		42.3	

* *Leon Trilling, assistant professor of Aeronautical engineering at Massachusetts Institute of Technology, author of "Soviet Education in Aeronautics, a Case Study."*

technology. It may be expected that Ivan Petrovich spends some 55 hours a week on his studies, which take up 34 weeks, and an additional 3 weeks in January between semesters and 4 weeks in June at the end of the school year devoted to some ten formal examinations and a dozen *zachety*—informal tests or examinations of work done. He has two weeks' vacation in January-February between semesters and two months in summer (July-August). During his vacation Ivan Petrovich may either go home or travel over the country if he can afford it, or he may go to one of the rest homes which his professional union keeps available to students at a nominal cost.

During his second year, Ivan Petrovich must still study Marxism-Leninism and one foreign language. He takes another stiff course in mathematics (calculus and differential equations) and a stiff physics course (sound, light, and elementary electricity).

While the drafting courses now taper off, Ivan Petrovich begins to study some elements of aerodynamics and of strength of materials; and in the second half of the year he takes an elaborate course on airplane layout in which he learns how the different parts of various airplane types are fitted together and what role they play in the whole. The textbook used for that course (Shul'zhenko, *Aircraft Construction*, 1953) is a 547-page illustrated book with numerous layouts of current British, American, and Soviet aircraft.

(Many pictures of Western aircraft are reproduced unchanged from current U. S. trade publications—for instance, a detail drawing of the F-86 Sabrejet fighter and of the B-47 jet medium bomber, and sketches of aircraft component parts.)

Term Project Assigned

The text is primarily descriptive. This familiarization with the details of an aircraft is driven home by the assignment of a term project which consists in laying out an aircraft on the drafting board. The second-year course again lasts some thirty-three weeks, plus eight weeks of examinations—four between semesters, followed by two weeks' vacation, and four at the end of the academic year, followed by two months' vacation in the summer.

In the first two years the course material is essentially the same for all students of the Institute. In the third year specialization begins. Since Ivan Petrovich belongs to the Faculty of Airplane Design, he postpones study of hydraulic and electrical engineering and takes courses in aerodynamics and structures, which are fundamental to his option. Besides the inevitable course of political economy, he must take an additional mathematics course (advanced calculus and partial differential equations).

UNIVERSITY OF MOSCOW with 20,000 undergraduates emphasizes technical training. An appreciable larger proportion of contact hours are given the student, making for a more directed, rigid program than in American universities.

The backbone of the third year's work is a general aerodynamics course (textbook: Arzhanikov and Maltsev, *Aerodynamics*) with a laboratory course on aerodynamic measurements and testing techniques (textbook: B. N. Yurev, *Experimental Aerodynamics*). In addition, he has a series of courses on the metallurgy of light alloys and of aircraft steels (textbooks: Geveling, *Aircraft Metals*, and Vinarov, *Aircraft Steels*), and on the theory and application of aircraft structures (A. A. Umanski, *Aircraft Structures;* Iskritskii and Tsydzik, *Laboratory Manual in Aircraft Structural Mechanics*).

In the second semester he also takes a course in applied thermodynamics (Inozemtsev, *Heat Engines*) and a survey course in electrical engineering (text: Bykov and Gakfeld, *Electrical Engineering for Aviation Schools*).

Several of the textbooks mentioned above were available to the author for study. In particular, the aerodynamics course is a well-written, mainly theoretical treatise which would require the knowledge and maturity of a good junior or a senior in this country.

The program again calls for two term projects, the first one being some aerodynamics calculation such as the lift and pitching moment of an airfoil section, and the second the detailed design of an aircraft component, for instance, a rudder with its hinge and trim tab. The school year again consists of thirty-three weeks of courses and seven weeks of examination with two weeks off between the semesters.

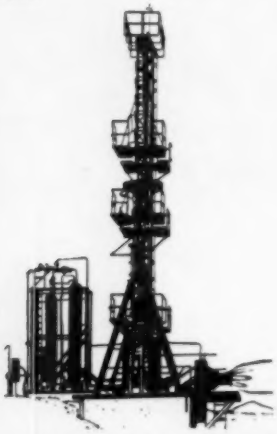
The summer vacation after the third year is shortened to six weeks. The remaining two weeks of the normal summer vacation, one week of the usual examination time, and one week of the fourth fall semester are used for the first four-week industrial practice session. The standard curriculum includes four such four-week practice sessions altogether: the first at the end of the third year, two more after each semester of the fourth year, and the last after the first half of the fifth year. Finally, an eight-week "diploma" practice session comes after the fifth year.

Assigned Regular Jobs

During these practice periods students are assigned to regular jobs in factories, the purpose being to add practical background, substance, and perspective to their classroom learning; and so it is customary for each technical institute to be loosely connected to a local plant or laboratory. Each aeronautical institute is located in the same

LIQUID ENGINE DIVISION

In piloted aircraft, missiles, and upper-atmosphere research vehicles, Aerojet-General liquid-propellant rockets have proven unexcelled for assisted takeoff, superperformance, and as prime power-plants.



Whether your interest lies in Vanguard or valves, Aerojet-General offers a variety of challenging assignments for:

Mechanical Engineers
Electronic Engineers
Chemical Engineers
Electrical Engineers
Aeronautical Engineers
Civil Engineers
Metallurgists
Chemists
Physicists
Mathematicians

Aerojet-General
CORPORATION
A Subsidiary of The General Tire & Rubber Company
AZUSA, CALIFORNIA
SACRAMENTO, CALIFORNIA

Write: Director of Scientific and Engineering Personnel, Box 296N, Azusa, Calif. or Box 1947 Sacramento, Calif.

MI-4 HELICOPTERS, with anti-tank gun and weapons carrier each helicopter delivers, in mock airfield assault at Tushino. Mi-4 has rear clamshell loading doors.

area as a manufacturing plant.

The Ordzhonikidze Institute Design Faculty, for instance, is cooperating with Aircraft Factory No. 22 in Moscow. Practice assignments may also be made to ministry research institutes like TsAGI or to design groups.

The first practice session assignment —before a student's specialization has proceeded much beyond the selection of a faculty—is deliberately made at random so that he may acquire broad experience in his industry. As he progresses, there is no systematic plan for shifting him from department to department to give him a comprehensive idea of plant activities, but an effort is made in the later sessions to coordinate the practice with the principal field of study of the student—which can be arranged on the average slightly more than half the time.

The prethesis "diploma" practice session at the end of the fifth year, however, is generally along the student's main line of interest and often suggests the subject of his diploma project, part of which may be carried out at or in close contact with the industrial facility —all the more easily if the thesis supervisor also works there on the research staff or as a consultant, as is often the case.

Landing Gear Practice

Ivan Petrovich, then, spends his first four weeks of practice in the landing gear subassembly department of Factory No. 22 and is then ready to start the fourth year of his training. He becomes attached to the Chair of Flight Mechanics within the Faculty of Airplane Design, which means that he plans to study the performance, stability and control characteristics of aircraft rather than their structural construction.

His load in structures courses is lightened. He must now take a series of survey courses given by the chairs of the other faculties on the phases of their work which bear on his specialty; and he must concentrate more deeply on the details of performance and control analysis. In his major field he takes advanced courses in stability and control (text: Ostoslavski and Kalachev, *Longitudinal Stability and Control of Aircraft*, 1951) and in aircraft performance calculations (Goroshchenko, *Aerodynamics of High Speed Aircraft*—Lectures, 515 pages; Problems, 271 pages; 1954). His supporting courses include performance and design of modern engines (Inozemtsev and Zuyev, *Aircraft Power Plants*), design of hydraulic equipment for aircraft (Bashta, *Aircraft Hydraulic Drives and Units*), performance and designs of electrical equipment (Rubin, *Electric Devices for Aircraft*), and an introductory course in electronics and radio technology.

High Quality Textbook

Of course, he must also take the usual course in political economy. Two term papers are required of him, one an elementary engine layout and the other an aircraft stability analysis.

Of the fourth year textbooks, *Longitudinal Stability and Control of Aircraft* by Ostoslavski and Kalachev has been examined by this writer. It appears to be a high-quality, advanced textbook which gives an exhaustive discussion of the problems involved and possibly a more detailed description than would be the custom in an American text of the gadgetry currently available to cope with these problems. This latter approach is employed to extreme lengths

s'Gravesande's Stoomwagen

s'Gravesande's Steam Reaction Car

In 1721 Jacob Willem s'Gravesande of Delft, stimulated by the recently enunciated Third Law of Motion, astounded the Royal Society by constructing a practical steam reaction car. The vehicle actually moved several times its own length, a distance of about two meters.

In 1956 the goal is no longer meters, but hundreds, and even thousands, of miles. Aerojet-General Corporation, leader in American rocket propulsion for more than a decade, is proud to participate in man's first assault on the frontiers of outer space—Project Vanguard.

Aerojet-General CORPORATION

A Subsidiary of The General Tire & Rubber Company

AZUSA, CALIFORNIA
SACRAMENTO, CALIFORNIA

Aerojet-General invites scientists and engineers—men of imagination and vision—to join the attack on the most significant research, development and production problems of our time.

in Bashta's *Aircraft Hydraulic Drives and Units*.

Mr. Bashta turns out to be the director of a major factory for hydraulic aircraft devices, and his book consists primarily of a detailed, exhaustive, beautifully illustrated survey of the construction and operation of rotary pumps, drives, gearings, piston pumps, actuating cylinders, boosters, fittings, safety valves, and so forth, with a minimum of general exposition on the role of hydraulic equipment in the operation of modern aircraft, but all the information needed to build these devices, including engineering drawings with dimensions of parts and tolerances.

During the last full school year Ivan Petrovich completes the survey of the aeronautical field with courses in the construction, assembly, tooling, and automation of production, in safety engineering, and in the economics and management techniques of the aircraft industry. A larger effort is concentrated on courses in instrument design (text: Kniazev and Polishchuk, *Aircraft Instruments*), automatic controls (Olman, Solovev and Tokarev, *Autopilots*), and an advanced course on radio instrumentation.

The main part of his time is spent on courses in lateral stability and control (Vedrov, *Aircraft Dynamic Stability*), advanced performance problems, and flight testing techniques (Vedrov and Taits, *Flight Testing of Airplanes*). His term papers may require a study of a production process observed during a previous practice session and an analysis of the automatic control of an aircraft-instrument system.

Useful Connection

The location of the last practice session is of crucial importance. Not only does it often suggest a diploma project topic if the work done is along the principal line of interest of the student; but also, if the young man likes his work there and makes a good impression, he may make a useful connection with a view to assignment there after graduation.

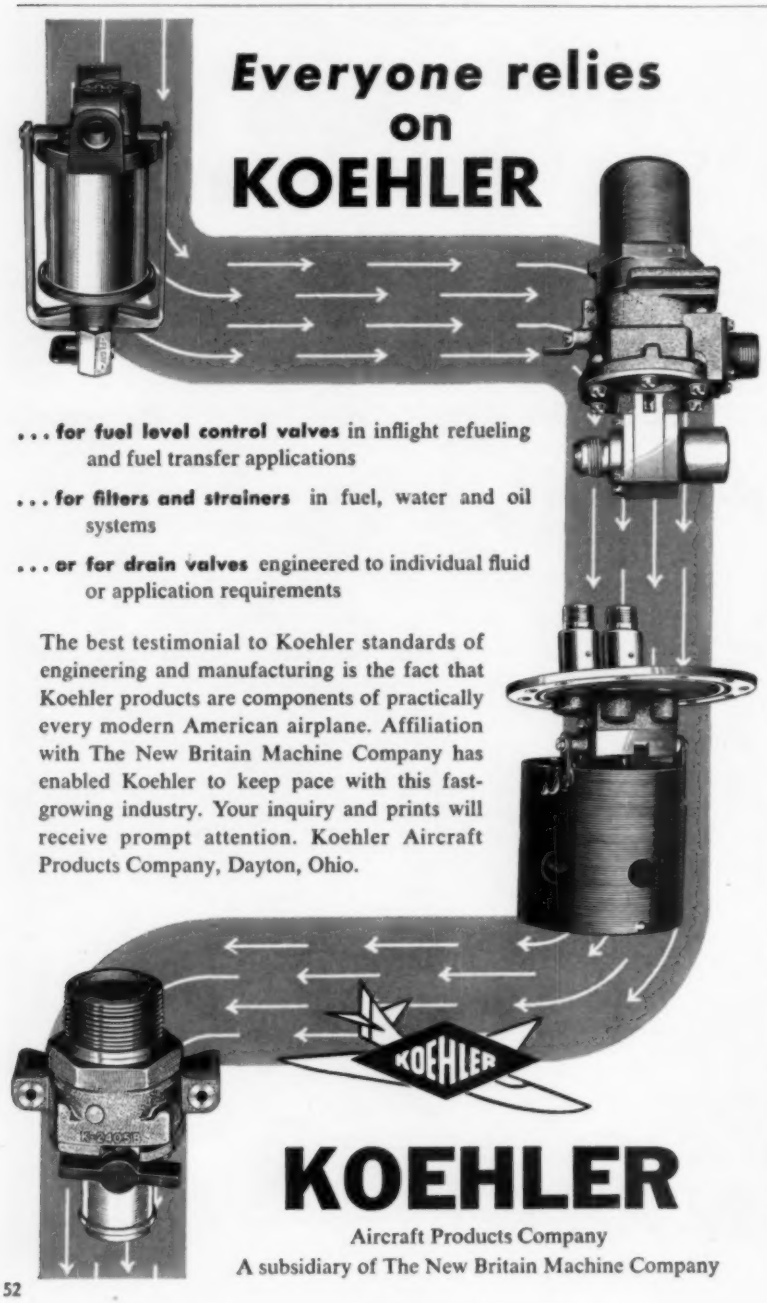
Ivan Petrovich, using his father's name with discretion, is lucky enough to wangle an assignment with a research and pilot production group for a new rocket, and he works on a guidance system in his last practice session.

Although many thesis supervisors are too busy to require a piece of original work as a diploma project and are satisfied with a detailed literature survey, an illustrative calculation, or a corroborative experiment, the aspirant in charge of Ivan Petrovich's group has sufficient enthusiasm and energy to help his young students formulate new problems and also to advise them on how best to approach a solution. Ivan Petrovich does so well, displaying both initiative and common sense, that his practice results form the basis of his diploma project.

Three Openings

Since the work in question is classified, his thesis must be defended behind closed doors rather than in public, as the old but increasingly disregarded custom would require. After he has successfully defended his thesis it is hardly a surprise to Ivan Petrovich that of the three openings from which he must choose for his three-year *stazh* assignment the first would return him to the group where he worked on his last practice session. For the harsh severity of the official regulations can always be softened by the application of what used to be called *blat* and is now known as ZIS (*aznakomstva i sviazi*, acquaintances and connections).

Ivan Petrovich's training has been so specific and detailed in the last two years of school that, in principle at least, he requires no further training on the job to be able to discharge the responsibilities which are immediately assigned to him. We may safely leave him there. After an initial period of muddling, while he discovers that real problems are not as clearly presented as those in the textbook, he will learn his way around and fit himself to the


Everyone relies on KOEHLER
. . . for fuel level control valves in inflight refueling and fuel transfer applications
. . . for filters and strainers in fuel, water and oil systems
. . . or for drain valves engineered to individual fluid or application requirements
The best testimonial to Koehler standards of engineering and manufacturing is the fact that Koehler products are components of practically every modern American airplane. Affiliation with The New Britain Machine Company has enabled Koehler to keep pace with this fast-growing industry. Your inquiry and prints will receive prompt attention. Koehler Aircraft Products Company, Dayton, Ohio.
KOEHLER
KOEHLER
Aircraft Products Company
A subsidiary of The New Britain Machine Company

Thompson provides the *greatest* economy in aircraft tire retreading. Cost-per-landing is lower because number of landings per tread is higher. These additional landings result in fewer costly wheel changes. Thompson, the developer of multiple retreading, has the experience and equipment to provide the maximum number of safe retreads to any casing regardless of make. Each casing received by Thompson is critically examined by expert inspectors to determine its individual suitability for retreading or top-capping. This insures that every Thompson Extra-Landings Tread is safe and dependable regardless of the number of times the casing has been previously retreaded. These inspection and performance advantages are provided only by Thompson!

THOMPSON

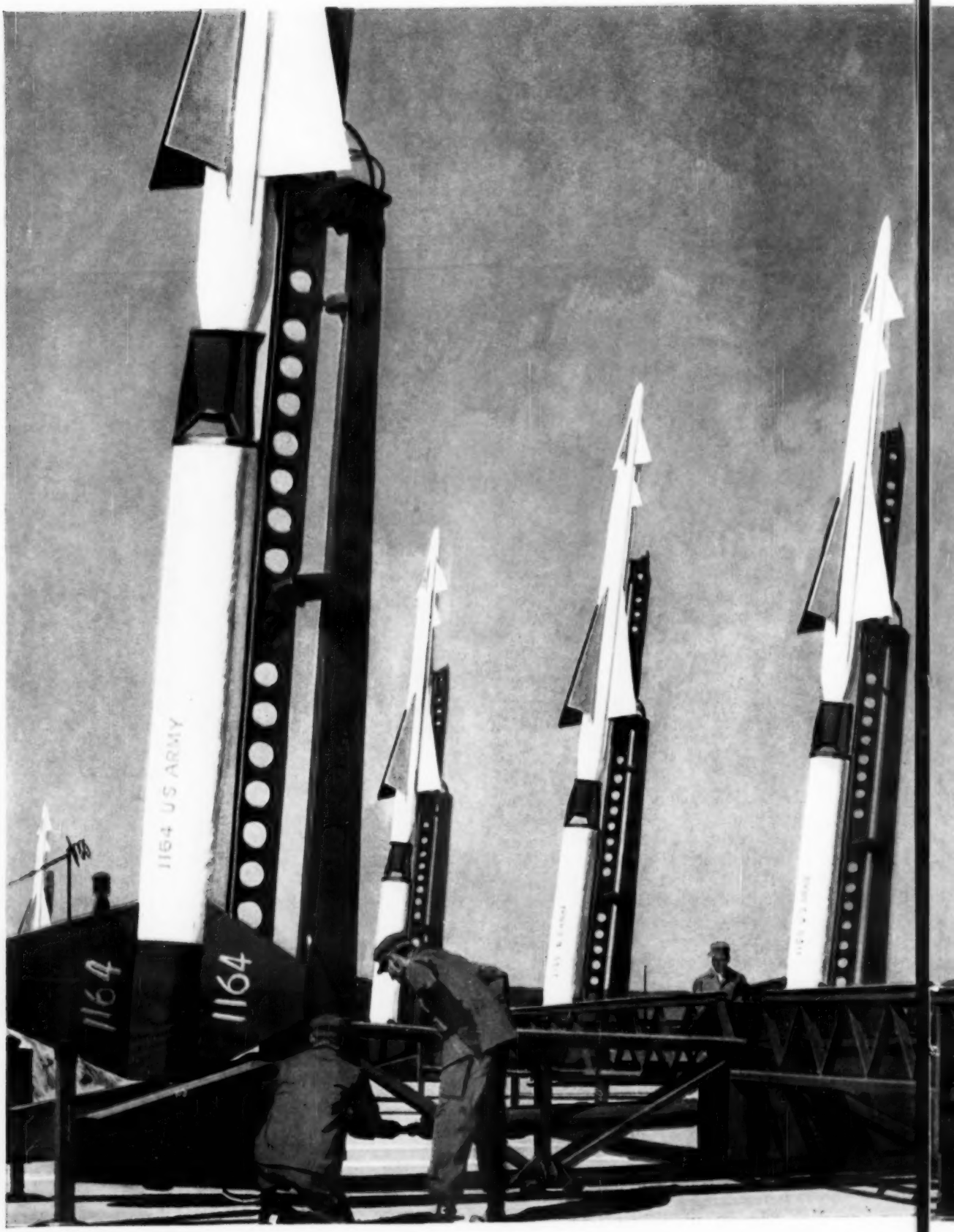
EXTRA-LANDINGS RETREAD

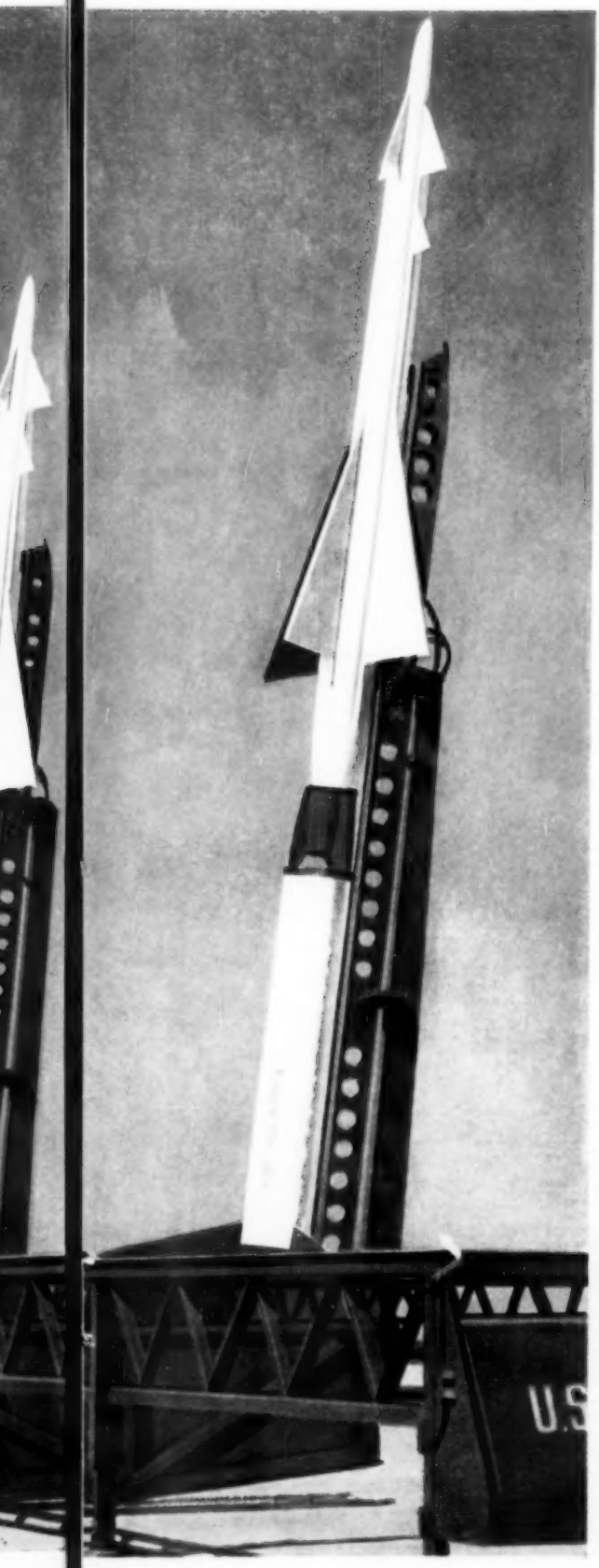
THOMPSON AIRCRAFT TIRE CORPORATION

18th and Minnesota Streets
San Francisco 7, California
MIssion 7-7320

International Airport
Miami 48, Florida
TUxedo 8-1681

530 Ray Street
Freeport, New York
FReeport 9-8100


1164 US ARMY
1164
1164



"Fireworks"— for Independence Day!

A RECEPTION awaits any aggressor who would trespass our skies.

For today, on the outskirts of an increasing number of American cities, deadly guided missiles point skyward.

They look like giant skyrockets.

They are literally "fireworks"—for independence!

Pilotless, within them throbs an electronic pulse. Poised for the push of a button they stand ready to rush into the sky—to unerringly track and destroy any marauder.

Goodyear Aircraft Corporation has developed and manufactures the booster cases that start these missiles to their elusive targets.

And for others it builds the "ATRAN" Guidance Systems, ground handling equipment, and various missile components.

Teamworking with the government and America's aeronautics manufacturers, Goodyear Aircraft has contributed importantly to many other devices developed for our nation's defense effort.

For our warning network, Goodyear Aircraft builds radar structures for far-flung sentinel posts—aircraft radar and radomes—and versatile airships, the roving aerial pickets which protect our air and sea approaches.

For our military air arm, Goodyear Aircraft builds weapons systems, cockpit canopies, escape capsules, laminated plastic radomes, lightweight structural materials, wings and many other vital components for virtually every ship in service today.

They're Doing Big Things at

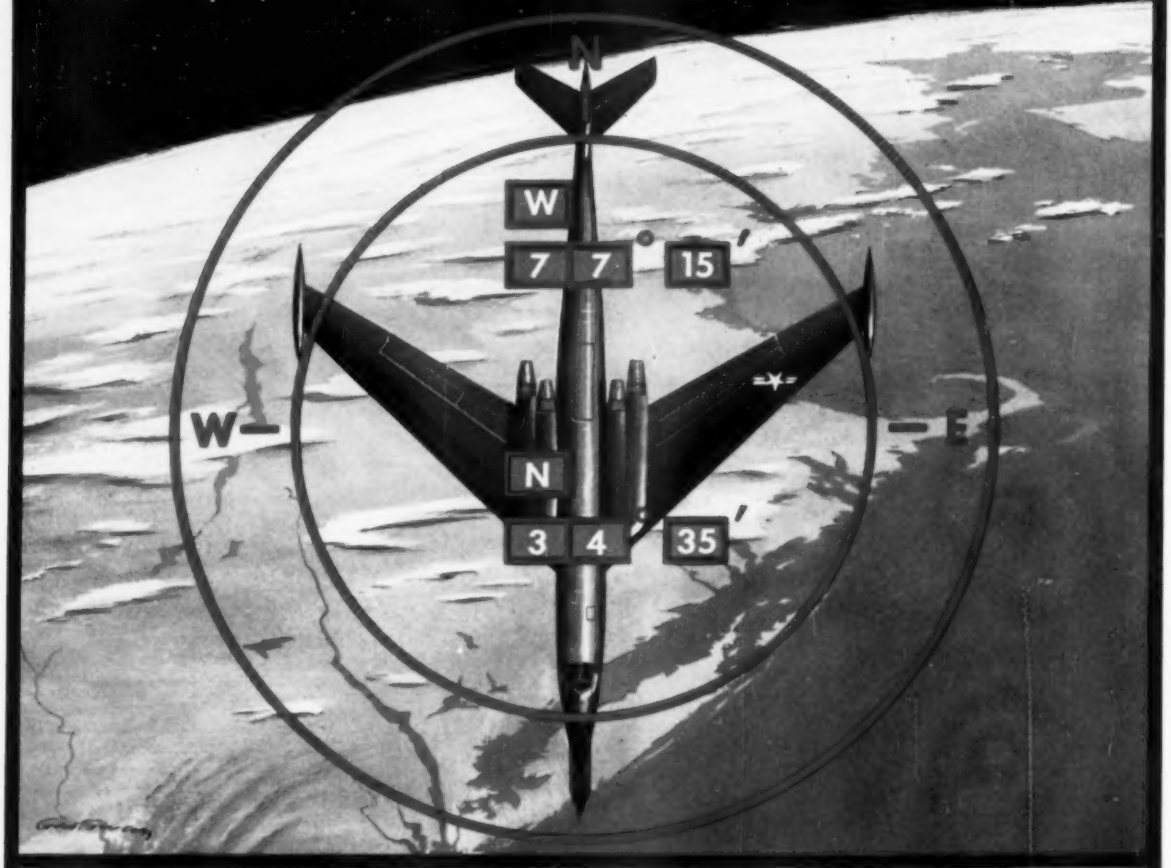
GOODYEAR AIRCRAFT

Plants in Akron, Ohio, and Litchfield Park, Arizona
Rewarding Careers for Engineers

Write for "Ribbons of the Valiant"—new, full-color booklet which tells the interesting role of Goodyear Aircraft Corporation in serving American air power. Requests are invited on company or service letterhead. Address: Goodyear Aircraft Corporation, Dept. 931AT, Akron 15, Ohio.

ATRAN—T.M. Goodyear Aircraft Corporation, Akron 15, Ohio

another example of how **RYAN BUILDS BETTER**



NOW! AUTOMATIC NAVIGATION FOR GLOBAL JET FLIGHT

An advanced system of aerial navigation, with the speed and precision demanded by high speed jet flight, has been developed by Ryan under sponsorship of the Navy's Bureau of Aeronautics. Using continuous-wave radar, in which Ryan is a recognized leader, the Ryan AN/APN-67 navigator will enable fast-flying military planes and future commercial jetliners to travel to any point on the earth's surface with new accuracy and speed.

Instantaneous in operation, the Ryan navigator gives the pilot his position (latitude and longitude), *ground* speed, *ground* mileage, drift angle and *ground* track in continuous, readable form. No computations are necessary. The equipment is compact and self-contained. No ground facilities are employed—no wind information or aerological data are needed.

This significant contribution to jet navigation is typical of the work which Ryan and the military services are accomplishing in other fields of electronics research such as supersonic missile guidance for the Air Force and helicopter hovering devices for the Navy.

Electronics engineers will find a challenging future with outstanding opportunities at Ryan

With a background of 33 years experience in aviation, Ryan excels in designing and producing high quality aircraft, power plants and avionics, built at low cost, delivered on time.

RYAN
AERONAUTICAL COMPANY
SAN DIEGO 12, CALIFORNIA

place which his degree of technical initiative and political conformity made for him.

Mainly Accurate

The curriculum of the five-and-a-half year undergraduate course at the Moscow Aeronautical Institute was synthetized for this study on the basis of the known aeronautical textbooks and the detailed curricula which have been obtained for a number of other than aeronautic courses in Soviet engineering schools. Although the synthetic *uchebnyi plan*—that is, the academic program—recreated on this basis must inevitably contain errors of detail, it is believed that it is accurate as to its main features and essential characteristics.

A comparison of the Moscow Aeronautical Institute (MAI) and the Massachusetts Institute of Technology (p. 48) suggests several comments. The service course loads are not dissimilar although there seems to be slightly more basic science taught at MIT, a difference which may not be significant since a good deal of science, especially mathematics and physics, is covered in the special technical courses.

It is surmised that the content of the MIT humanities courses constitutes more nourishing intellectual fare than the indoctrination courses mostly taught by rote in all Soviet schools. The major technical fields are covered more thoroughly at MIT, especially insofar as design is concerned, a difference which points up an acknowledged relative weakness of Soviet engineering. The main difference in technical content, however, lies in the thorough, relatively detailed training which Soviet engineers get in their minor fields.

Rigid Direction

Another important difference is the appreciably larger proportion of contact hours (lecture, lab, and seminar) which characterizes Soviet education and helps give it its directed, rigid character. A related factor, more difficult to document, is the small choice of electives offered in Soviet courses. The maturity and basic knowledge required to absorb the material of the more advanced Soviet textbooks appear of the same order as those required of a candidate for the masters' degree at MIT.

In particular, such science electives as geology or botany, which are taught here to encourage the development of a more broadly civilized being, are absent from the Soviet curriculum because they do not contribute to the professional training of an aeronautical engineer.

Contact with creative mathematicians, physicists, electrical engineers, and other specialists, made possible in American schools by their proximity, is actively encouraged in American education as a matter of policy in an effort to train men not to be simply aeronautical engineers but, rather, men broadly acquainted with many engineering problems whose main training and interests lie in the field of aeronautics.

YAK-24 two-engine helicopter with two four-bladed rotors. Yak-24 carries 8,800 lb. payload. Note vertical fin addition over earlier models.

In the Soviet Union the aeronautical engineer will be familiar with most of the problems which now arise in his field, but his thinking is bounded by the limits of that field. Thus, even if his knowledge is adequate, his outlook is parochial.

We may admire the competence and thoroughness of Soviet textbooks, but we wonder whether things are not spellled out in too much detail, particularly in texts on applications and products such as Bashta's. The deliberate effort to produce encyclopedic textbooks may be the consequence of a teaching staff short in numbers and, except in Moscow, uneven in quality. The senior professors at the Ordzhonikidze Institute are simultaneously supervisors of the research staff at TsAGI or professors at the Zhokovskii Military Air Academy. Moreover, they generally carry responsibilities for formulating long-range research programs as members of Academy of Sciences committees and act as consultants to industry (examples: Yurev, Gudtsev, Yakovlev, etc.).

Sometimes their main jobs are off the campus. Many courses on aircraft equipment and special manufacturing processes are taught by outstanding industrial engineers (such as B. T. Bashta). An elaborate textbook may be considered as the most efficient method for enabling a small number of excellent part-time teachers to mass-produce engineers, the larger number of younger or less skilled docents being employed as a mere transmission belt.

Books Obsolete

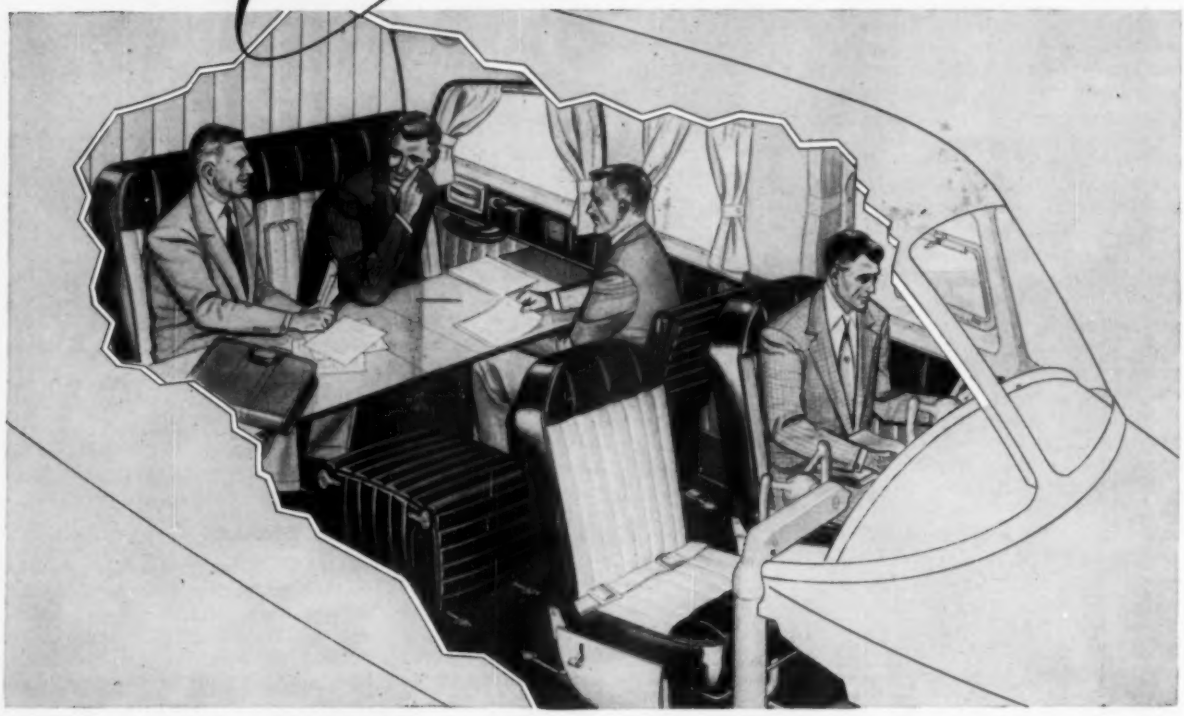
This procedure lays a heavy burden on the student. The material is all there in the book, and a serious student naturally does his best to learn it; but there is too much factual information there, and it cannot be absorbed except by rote. The guiding principles may be so buried in the mass of material that a young student may not be able to dig them out.

In some important fields of engineering, detailed books become obsolete shortly after being printed, a condition which the Soviets apparently recognize, since new editions of Shul'shenko's textbook on layout and Goroshchenko's book on performance seem to be published every three years. The engineer in the field may find it more than normally difficult to relearn his trade every few years if the process requires absorbing numerous new detailed facts without the guidance provided by a knowledge of basic ideas; and such ideas are best imparted by personal contact between student and teacher.

In addition, the education of an engineer must go beyond the communication of technical knowledge, for one of its fundamental purposes is to train young men to think out problems and to take independent decisions. The Soviets, aware of this fact, stress the laboratory work and term and diploma projects; but recent visitors report that, although laboratory equipment is plentiful and of sufficiently good quality, the experiments are all set up and the

IN BOTH GREAT

Commanders



"Room To Be Comfortable"

Flexibility and Utility in both great Commanders are made possible by the long, roomy cabin. Ample space is provided for such optional accessories as the multiple use hassock seats and tuck-away conference tables.

One Easy Step...

AERO Commander

560-A · 680-SUPER

Write For Catalog 128-A Write For Catalog 128-S

AERO DESIGN & ENGINEERING CO • TULAKES AIRPORT • P. O. BOX 118 • BETHANY, OKLAHOMA

students need only record the data.

This impression is confirmed by the study of the few available laboratory instruction books, which are detailed to the extent of giving models for the arrangement of data on the lab-notebook pages for each experiment, a practice which makes the work of grading dozens of reports easier for the reader but hardly encourages initiative among the students.

One minor point requires comment. In reading the prefaces and the historical introductions of Russian textbooks we were struck by the narrowly chauvinistic interpretation of engineering and science history. No one would quarrel at the praise heaped on Zhukovskii and Chaplygin, whose important contributions to aerodynamics are recognized everywhere. But leading academicians (Yurev, among others) state that Mozhaiski built the first airplane in 1881 (twenty-two years before the Wright brothers) and that his claim is disputed abroad only because, after his unsuccessful attempts to fly his plane, the narrow-minded Tsarist government refused to continue support of his work. An important aerodynamic parameter known the world over as the Mach Number "M" (ratio of airspeed to the speed of sound) is conveniently called the Makovski Number, after a Russian ballistician whose name also starts with the letter "M," thus avoiding the need to change all the equations in foreign papers or to explain why foreigners use the letter "M."

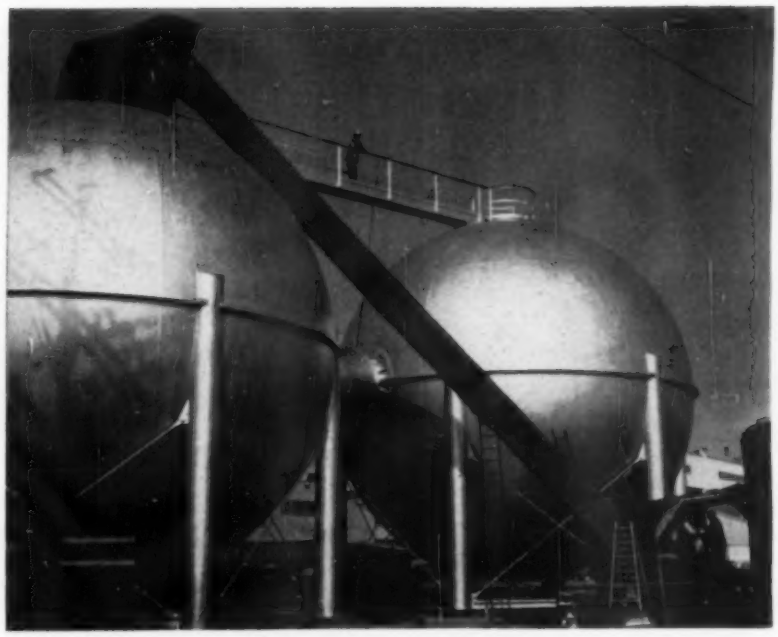
It appears, in conclusion, that the training of the average Soviet aeronautical engineer consists largely of a diet of predigested facts. It puts a large up-to-date amount of detailed information and know-how at his disposal, but it does not develop in him the broad outlook and the versatility notable in the better Soviet applied mathematicians. It can hardly be said either to stress individual effort or to encourage either originality or initiative in the student.

Work of Russian Scientist Translated

Selected works of a Russian aerodynamicist, Sergei Alekseevich Chaplygin, are now available in English, according to the translator, Dr. Maurice A. Garbell of the Garbell Research Foundation.

Original Russian language version of *Selected Works on Wing Theory* was published by the Soviet government in 1949. It covers Chaplygin's pioneering contributions to classical aeronautical theories.

The Garbell Foundation, 1714 Lake St., San Francisco 21, Calif., is selling paper bound copies of the 97 page translation at cost for $5.00.



Millions of Tin Cans

Boeing Airplane Co. is filling the two 38 ft. air storage spheres for its new supersonic wind tunnel with tin cans to act as heat source to prevent the moisture in the air from condensing out and forming "tunnel fog" as it expands into the test section. Belt carrying the 3 million cans up to tanks is covered to keep dirt out. The Seattle facility will have a 4 by 4 ft. section and 15 second runs. Spheres will be charged to 150 psi.

Here's the **SMALLEST and LIGHTEST**

Quick Disconnect in the Air...!

New MARK II SPEED-RIG

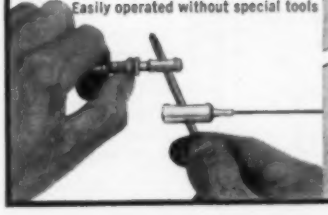
TRADE MARK

CONTROL CABLE is quickly disconnected with the new Mark II Speed Rig...and can be restored to identical tension in a matter of seconds—*without re-rigging!*

Ideal for use where space and weight are critical, the miniature Mark II is available for swaging directly to a cable, or can be furnished with a threaded end to replace any existing standard turnbuckle.

All the advantages and convenience of a quick disconnect *and* a turnbuckle are now available *for virtually the same weight as a standard turnbuckle alone!*

For greater design freedom, easier maintenance and faster inspection, the Speed Rig is indispensable. Write today for Pacific's new bulletin on Control Cable Quick Disconnects—no obligation, of course!



Pacific PACIFIC SCIENTIFIC COMPANY

P. O. BOX 22019, LOS ANGELES, CALIFORNIA

San Francisco • Seattle • Arlington, Texas • San Diego

REPRESENTATIVES: AERO ENGINEERING CO., Atlanta, Ga. • Baltimore, Md. • Indianapolis, Ind. • Minneola, L.I., N.Y. • Columbus, Ohio • St. Louis, Mo. • GARRETT MFG. CORP., Toronto, Canada. In England: TELEFLEX PROD., LTD. In France: SARMA—St. Vallier

HYPERSONICS

AT CORNELL AERONAUTICAL LABORATORY

This is the "business end" of a shock tunnel. The photograph illustrates its use to obtain data on hypersonic flight . . . data which will be needed to engineer intercontinental missiles. The shock tunnel was conceived by a Cornell Aeronautical Laboratory engineer six years ago and was initially developed under a self-supported internal research program, and later by Air Force contract. Today the tunnel has become a basic tool for the study of high-speed gas dynamics.

The hypersonic program is one of the 160 technical research projects that are currently in progress at C. A. L. These projects deal with almost every area of research related to the challenging problems of modern flight. Electronics, materials, atmospheric physics, weapon systems, and applied mathematics are among the many stimulating areas of research available at C. A. L. for the professional man with an inquisitive mind.

CORNELL AERONAUTICAL LABORATORY, INC.
OF CORNELL UNIVERSITY

The story behind Cornell Aeronautical Laboratory and its contributions to aeronautical progress is vividly told in a 68-page report, "A Decade of Research." Whether you are interested in C. A. L. as a place to work or as a place to watch, you will find "A Decade of Research" both useful and pertinent. Mail in the coupon now for your free copy.

G. V. Kopp
CORNELL AERONAUTICAL LABORATORY, INC.
Buffalo 21, New York

Please send me "A Decade of Research."

Name

Street

City Zone State

☐ Please send employment information.

FIRST BUILDINGS (left) of Curtiss-Wright's Quehanna Research and manufacturing area. These are clustered in a clearing near the main entrance gate. The nuclear reactor under construction and the outdoor engine test stand are located a few miles further down the main road near the center of the 10 mile diameter woodland area. Large building on the left mainly is engaged in manufacturing plastic sponges for commercial market. Higher section at the back of the building on the right is where engines are built up for the outdoor test stands. J65 rolled up on its trailer (right) onto the simple outdoor test stand. Curtiss-Wright is using this stand for their twin-spool J67 development, reverse thrust, high energy fuels, and, with the aid of a small blower arrangement, for air start tests of a small axial-flow gas turbine (possibly the Armstrong Siddeley Viper)

Curtiss-Wright Adds $50-Million To Original Quehanna Investment

Quehanna, Pa.—Fifty million dollars has been added to the original $20 million invested in Curtiss-Wright's research and manufacturing center here, which will bring the total investment up to $70 million in a few years. The additional $50 million comes from both company and Air Force sources in undisclosed ratios, Roy T. Hurley, president of Curtiss-Wright stated.

It is not clear to just what extent C-W will use the center for testing or for manufacture. Officially, the company said it will be "dedicated to scientific research in aerodynamics, thermodynamics, metallurgy, chemistry, nuclear energy, ultrasonics, electronics and plastics . . . including the stimulation and achievement of the greater aircraft engine powers of tomorrow."

Non-Defense Business

However, reporters who toured the new facility, still in a very formative stage, noticed efforts devoted to the manufacture of C-W brand "Curon" foamed polyester plastic household sponges, rug undercushions and decorative interior wall coverings. This impression was re-enforced by Hurley's emphatic statements about his intentions to increase and maintain a healthy portion of Curtiss-Wright's business in non-aircraft and non-defense business.

Two major research test facilities planned for Quehanna are a nuclear reactor and an altitude cell for engine development. It was not definitely specified whether C-W would construct an air supply adequate for varying degrees of ramjet and turbojet flight simulation.

Quehanna was chosen because of its remoteness for nuclear and jet engine testing, plus a favorable labor supply. There are 100,000 potential workers within a 30 mi. radius of the center.

This combination is possible because Curtiss-Wright has been able to buy and lease land in the center of a state-owned forest preserve.

Pennsylvania justified the sale and lease of public land on the grounds it was vital to the welfare of the jobless in the area.

Gov. George M. Leader said the low percentage of return on the defense tax dollar to the citizens of his state was particularly deplorable because Pennsylvania produced more engineers per year than any other state.

Curtiss-Wright said it already has heard from graduates of nearby Penn State who have expressed interest in aircraft employment at the plant.

S-P Outshone Quehanna

During most of the Quehanna press tour the spotlight was directed away from the center towards Curtiss-Wright's recent purchase-option arrangement with Studebaker-Packard (AW Aug. 13, p. 26).

Hurley stated C-W bought S-P as much for commercial business as for defense contracts. He also said the funds for C-W's recent expansions had come more from commercial operations than defense.

Meanwhile, it was learned C-W will keep one of its newly-acquired S-P plants —the one at Utica, Mich.—busy with a $16.5 million Army contract to produce the Dart artillery missile for use by ground troops against tanks and bunkers.

New Air Freight Truck Raises to Level of Plane

A prototype of a new, air freight-handling truck, incorporating a body which can be raised more than ten feet to the level of a cargo plane's hold, is being used by Pan American World Airways at London Airport.

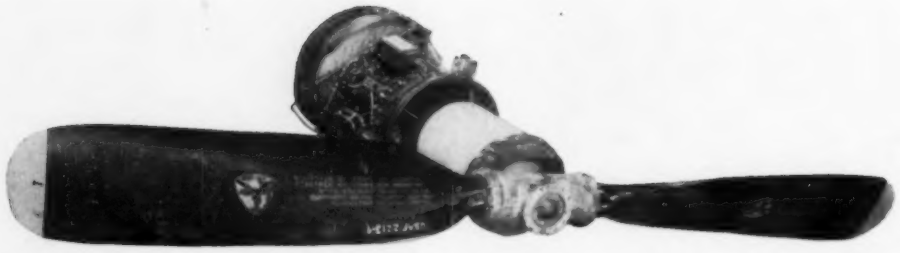
The truck is driven head-on to the aircraft and the body is raised hydraulically to the plane's cargo floor level. The driver can watch the body through a transparent Perspex panel in the truck's roof and stop it at the correct height. An automatically-controlled headboard is swung down across the cab of the truck and fits into the aircraft's door to allow freight to be moved from plane to truck.

Width of the headboard may be varied to accommodate different sizes of loading bays.

The truck body can raise 10 ft. 4 in. from the ground and can handle a 6,720 lb. load.

The headboard can support 2,240 lb. at a time.

The truck is manufactured in England by the Rootes Group.



New T53 Stimulates STOL/VTOL Firms

By Robert H. Cushman

Stratford, Conn.—Lycoming's T53 turboshaft engine has completed the Air Force's 50-hr. qualification test, and the company expects to start shipping engines by late 1957.

First publicized use for the Army-funded T53 is the Bell XH-40 utility helicoptor. But the existence of a reasonably lightweight turboprop powerplant (a 480-lb., 960-hp. turboprop development of the 825 hp. helicopter engine is scheduled for 50-hr. test within one year) should have an immediate, stimulating effect on the many firms entering the new STOL/VTOL competitions. Ryan, Vertol and Doak (a new firm in the Los Angeles area) are said to be designing around the T53.

Unusual Combustor

Design of the T53, and its twice-sized sister, the T55, which is about 6 months behind, has been thought out to provide a compact, rugged, serviceable installation as well as the power for weight jump over reciprocating engines which is typical of high speed rotating gas turbine machinery.

Cross sectional view of the T53 indicates the three most distinctive features:

- **Front location** of power delivery shaft.
- **Centrifugal last** stage of the compressor.
- **Combustor folded** back up and over the turbines.

These features, especially the novel combustor, harmonize nicely into a simple, short, engine. Because the power shaft comes through the engine the extensive reduction gearing typical of turboshafts is at the cool end. And because a single centrifugal last stage is substituted for what probably would have been three more axial stages and the unique hot end flow path allows the turbines to be tucked back up into the combustor, the T53 is very short. This reduces the shaft bearing and vibration problems and cuts weight.

Since the last stage of the compressor is centrifugal the flow is flung naturally outwards towards the puffed-out combustor. Then, as the combustor is on the back end of the engine, unbolting its aft cover not only exposes the inside of the combustor but the turbines as well. Hot end inspections can be made in less than an hour.

Perhaps the only disadvantage is that the envelope diameter of the T53 is fairly fat for the 10 lbs. per second airflow by present day standards. But design originator Anselm Franz, who is Lycoming's director of turbine engineering, says that the large turbojet engine practice of trying to keep the engine diameter down to the minimum axial flow compressor diameter breaks down on small gas turbines. . . . The small gas turbine's accessories are relatively too large to allow it. By the time the accessories are grouped around the compressor on a small engine the overall engine size has grown way beyond the basic compressor diameter.

What Franz' engineers have done is keep the rest of the engine within the diameter dictated by the axial portion of the compressor plus the starting motor-generator and other accessories.

The main reason for the centrifugal last stage (which creates about half the 5.9 compression ratio) was to avoid the manufacturing tolerance and altitude performance problems of equivalent axial stages. At altitude, these small axial blades would have encouraged boundary layer build choking and surge problems which in turn would have seriously limited the compressor's efficiency and control responsiveness.

XT53-L-1 Gas Turbine (Helicopter Version) Specifications

Shaft hp. (military rating)	825
(continuous)	770
Jet thrust	102 lbs.
Specific fuel consumption @ Military rating	0.71 lb/shp/hr.
Specific weight	558 lb/shp
Weight (dry)	460 lb.
Diameter	23 in.
Length	47.8 in.
Output rpm.	6,000
Power turbine rpm.	19,300
Wt. flow	10.4 lb./sec.
Compression ratio	5.9
Stalled torque (% normal torque)	170

GE T58 Comparison

In comparison with their closest rival, the General Electric Small Gas Turbine Division's T58, the T53 and T55 bracket the T58 in power but are not quite as spectacular in performance claims. One good reason for the T53's lower power to weight ratio is that this is Lycoming's initial entry into the gas turbine field and Franz' development group had to start from scratch with limited test facilities.

However, some industry experts feel that while the T58 has been designed quite near its ultimate, the Lycoming engine has quite a growth potential left.

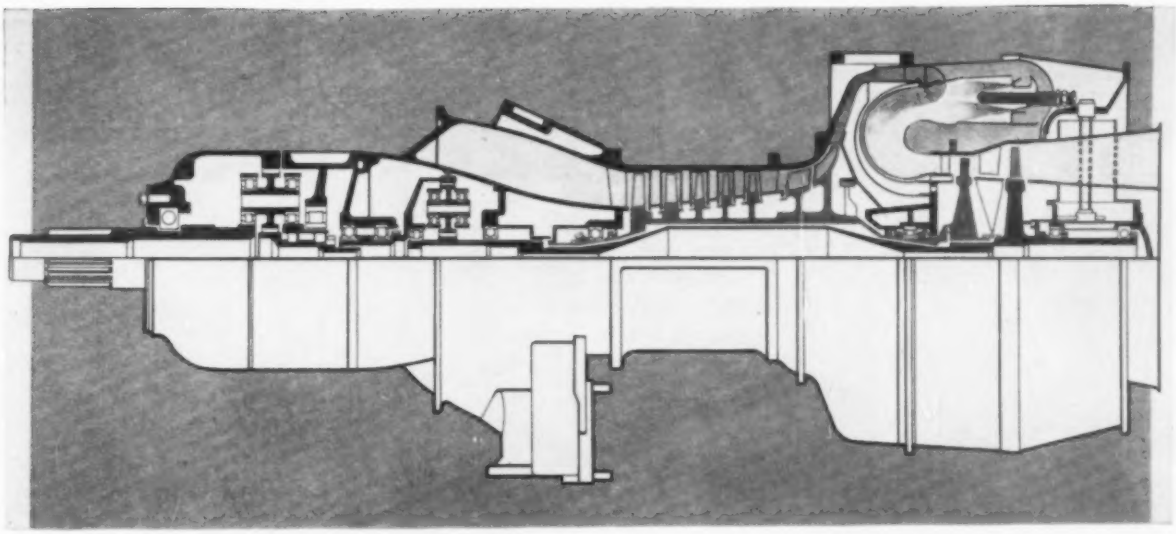
General Electric T58 designers took the opposite path from Lycoming on all three of the points previously mentioned as novel for the T53. T58 power take-off is from the rear, its compressor is pure axial-flow, and its combustor is not only straight through but, as designer Hokanson says, "was purposely made longer than necessary. About the only point of agreement between the engines is their common use of the free power turbine principle.

But, as their aims were similar, it is interesting to contrast the results.

Higher Compression Ratio

Very likely the superlative performance claimed for the T58 helicopter version, the .32 weight to hp. ratio as compared to the T53's .56 and the .66 specific fuel consumption at cruise compared to the T53's .71, comes from the GE compressor which not only has a higher compression ratio but obtains this with decidedly less weight.

However, GE has had to go to variable stator blading to obtain this without surge so these gains have been made at the cost of increased complexity in both the compressor and the control system. Main reason for the variable stator blading is to allow the compressor to rebalance the amount



CUTAWAY shows the clever flow path of T53 turboshaft. Note how centrifugal last compressor stage throws air out into the double-reversed-flow combustor; how compactly the two turbines are tucked back up inside the combustor. Good factor mechanically about configuration is that gas generating rotor is very short: the compressor-driving turbine is not separated from the last compressor stage by the usual in-line combustor.

of pumping between the first and last stages as the rpm. is varied. Without variable stator blading a compressor correctly designed for the high end of its rpm. will tend to have its first stages overpump air into its latter stages, thus choking the latter stages. Then this effect will work back and stall the first stages.

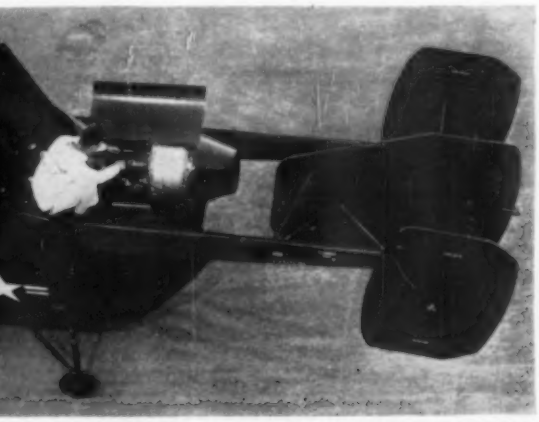
Because Lycoming splits its compressor between an axial front portion and a centrifugal rear portion the compressor is better matched to itself mainly because the centrifugal rear last stage is not so sensitive to how much air the forward stages push at it

Greatest Difference

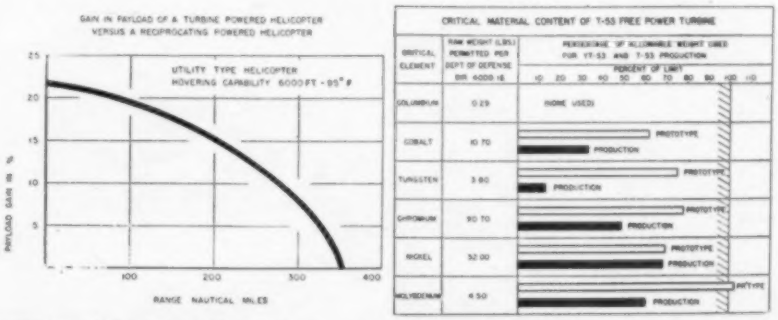
Next to the compressor, the greatest difference between the two engines is in engine length. This is another way of saying that their air-flow paths are radically different. While GE choose the conventional straight through flow, Lycoming looped its combustor flow through two 180 degree turns. Lycoming claims that despite this somewhat tortuous excursion their combustor pressure drop is lower than any other known design. But both firms have by their claims achieved long enough combustion paths so that the temperature profiles at their turbine blades are well distributed.

Lycoming says it is the evenness of its temperature profile which has allowed it to raise its turbine inlet temperature to 1,575F and boost the engine output during development.

As for the power output shaft location, both companies admit it is too early to tell what the customers, particularly in the case of turboprops, finally will want. Lycoming put the shaft where it will be handy to hang the prop. GE's intended shaft configuration with the shaft running forward alongside the engine (with an



KAMAN HOK with T53 shown here will start ground run-up next month. Bell XH-40 will follow in October. T53 installation will allow Kaman to employ HOK rear fuselage space and doors which formerly were used up by radial piston engine for litter handling. Lycoming points out location requirement of T53 power takeoff is similar to that of turboprop installation.



PERCENTAGE OF PAYLOAD gain when gas turbine is substituted for reciprocating engine in a helicopter is one justification for the costlier engine. Curve shows that for shorter 100-200 mi. range customary for helicopters lighter gas turbine more than makes up for greater fuel consumption.

Performance proved in flight
More light planes are equipped with Sensenich Propellers than any other make.
FIXED PITCH METAL
CAA approved up to 165 hp.
FIXED PITCH WOOD
CAA approved up to 225 hp.
TEST CLUBS
up to 3000 hp.
Write for Bulletins and Price Lists.
Dept. A, Sensenich Corp., Lancaster, Pa.
Sensenich PROP SHOP... Certified Repair Station for all makes fixed pitch metal or wood propellers ... Sensenich, Beech and Hartzell controllables. Magnaflux, etching, anodizing and plating service available. Service Hangar on Lancaster Municipal Airport. Approved Propeller Repair Station 3528. Unlimited Class 1 and 2 ratings.
AIRCRAFT
SENSENICH
PROPELLER
Sensenich Propellers
SERVING THE AIRCRAFT INDUSTRY FOR MORE THAN 25 YEARS

MARINES
MARINES' NEWEST...
U. S. Marines are now operating their newest type helicopter, the Kaman HOK-1. These twin rotor helicopters are used for cargo carrying, medical evacuation, personnel transport, observation, and search and rescue. These fine ships are the latest product of Kaman's ten years' development and production of helicopters for military and civilian use. Kaman is proud of the part it is playing in the furtherance of our National Defense effort.
KAMAN
THE KAMAN AIRCRAFT CORP.,
BLOOMFIELD, CONN.

undisclosed weight penalty) will permit an offset air intake after the fashion of the Allison 501.

In trying to compare turboshafts that are still under development, one must not overlook possibilities for future growth.

The T53 illustrates this.

In July 1952 the Army awarded the Lycoming Division of Avco Manufacturing Corp. a contract to develop a 600 hp. engine to mate with its XH-40 helicopter.

Less than one year later the T53's horsepower was upped to 720. This is the maximum hp. which the Bell helicopters can absorb.

This past June the T53's rating again was increased to the present 825. Thus the T53 has literally outgrown the vehicle for which it was intended.

Lycoming says the next jump will be to 960 hp. All of these increases have been accomplished by raising the turbine inlet temperature. Further engine modifications (which will both increase the temperature and alter the engine for increased weight flow) are planned to bring the T53 first to 1,200 hp. then culminate with a 1,400 hp. T53.

Once a new engine is finally "on the shelf," new airframes soon follow. Watch for the new airframes that will be built around the T53 and its competitors.

Bureau of Standards Checks Gases Data

A substantial contribution to the new science of gas dynamics has been made by the National Bureau of Standards in a series of measurements of the speed and attenuation of sound waves in monatomic gases.

The Bureau's work has provided new information on the characteristics of gases under non-equilibrium conditions, typified by those behind the strong shock wave on the nose of an ICBM.

Primary value of the data will be to aid comparisons of propagation theories based first on the assumptions of equi-

New Helicopter Records

Washington—U. S. Army last week claimed three new world helicopter speed records:

- **141.9 mph. over a 100-kilometer course.**
- **136 mph. over a 500-kilometer course.**
- **132.6 mph. over a 1,000-kilometer course.**

The marks were set by a Sikorsky H-34 and were timed by the National Aeronautics Assn. Russia claims to have flown a helicopter over the 500-kilometer course at 116.3 mph.

Mirror

Airman of Strategic Air Command shines 28 ft. high tail of B-47 six-jet bomber and is mirrored in its high gloss. Shine adds several miles an hour to speed of 600 mph., 3,000 mi.-range bomber.

librium, and second on the current concepts of gas kinetics.

The NBS work was supported in part by the Office of Naval Research. M. Greenspan of the NBS sound laboratory conducted the investigation.

Republic Expands Titanium Production

Cleveland, Ohio—Republic Steel Corp. will expand its facilities at Canton and Massillon, Ohio, for the melting, preparation, forging and research of titanium.

The $8 million program will increase Republic's ingot output of titanium and titanium alloys to about 12 million pounds a year.

C. M. White, Republic president, said the expansion program is expected to be completed in the autumn of 1957, with its initial phase being completed this fall. It is covered largely by a certificate of necessity granted by the Office of Defense Mobilization permitting accelerated depreciation of the new facilities.

Currently, about 95% of U. S. titanium production is going into military aircraft, although it is being used increasingly in such industries as civilian aircraft, chemical, marine, food processing, pharmaceutical, atomic power, electronics and petroleum.

Here is the versatile Pastushin Slug Rivet that gives absolute Fluid-Tight Construction

This photomachrograph of a sectioned specimen illustrates the sealing principle of the Pastushin Slug Rivet. Standard sizes 5/32"–3/16"–1/4" ...other sizes available.

The Pastushin fluid-tight slug rivet seals automatically. The exclusive fluid-tight seal is accomplished by the extrusion, or flow, of the .004 wall 1100 aluminum alloy sleeve into possible leak areas of the hole when the rivet is expanded during driving. Positive sealing is accomplished without the addition of foreign sealing agents.

Because Pastushin Slug Rivets do not have preformed heads, uniform flow of rivet shank material in the flush head and upset end is assured during the driving process.

PASTUSHIN REPLACEMENT RIVETS: For production or field maintenance, three types are available, Jacket, Washered, and Washer-Jacketed. Like the slug rivet, they are fluid-tight, have full rivet strength and are easy to install with conventional tools and methods.

Write for Slug Rivet catalog PI-5 and No. PA-3 for details on the Pastushin repair kit.

PASTUSHIN *Industries Inc.*

5651 WEST CENTURY BOULEVARD, LOS ANGELES, CALIFORNIA

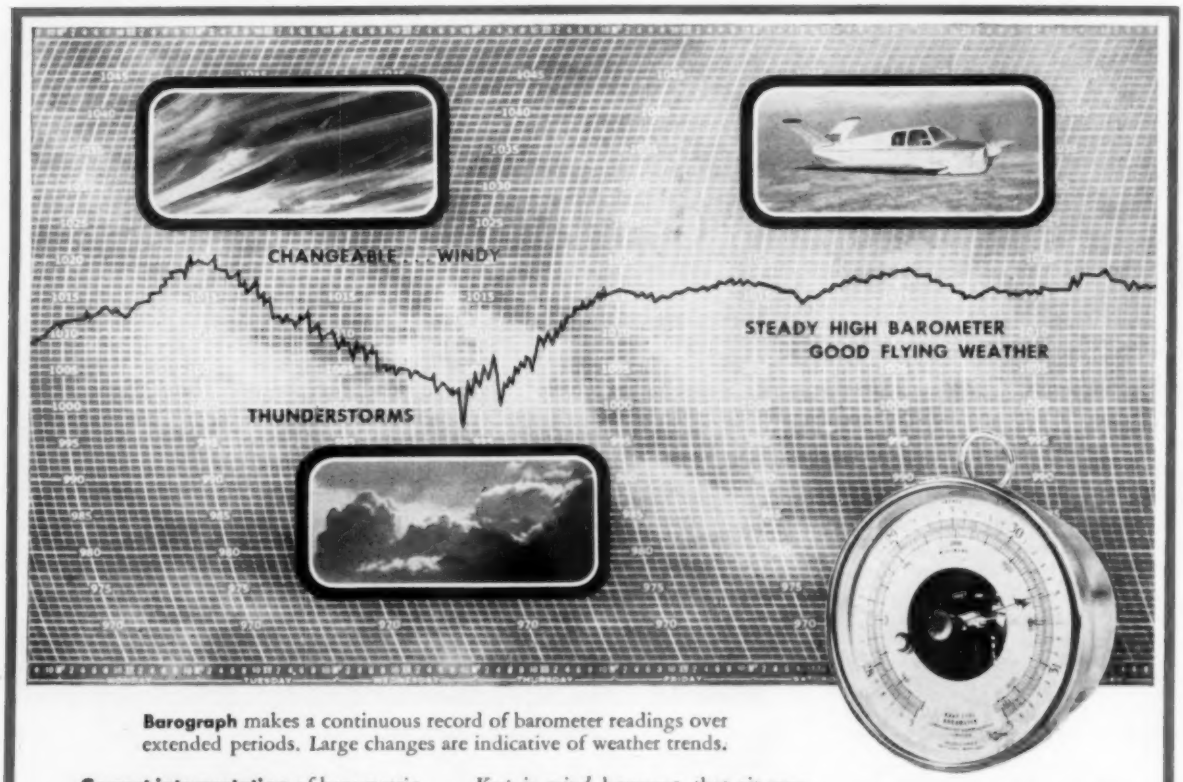
Developers and Manufacturers of Aircraft Fasteners

Affiliate Companies { **PASTUSHIN AVIATION CORP.**, Los Angeles, California
HAWAIIAN AIRMOTIVE, LTD., Honolulu, Hawaii

FLY WEATHER-WISE

These weather items prepared in consultation with the United States Weather Bureau

BAROMETRIC FORECASTING



Barograph makes a continuous record of barometer readings over extended periods. Large changes are indicative of weather trends.

Correct interpretation of barometric behavior can be a valuable aid in forecasting weather. As pilots know, a falling barometer indicates the approach of a low pressure system with associated bad weather. High winds can generally be expected when barometer rises or falls rapidly. Upturn indicates a windshift and improving weather.

Keep in mind, however, that air pressure normally goes up or down with daily rotation of the earth. Thus, atmospheric pressure is highest at around 10 A.M. and 10 P.M. Lowest at around 2 A.M. and 2 P.M. So a falling barometer between 10 A.M. and 2 P.M. does not necessarily indicate approach of a storm.

Aneroid barometer can be used to make your own generalized forecasts if record of readings is kept. Reset fixed reference hand frequently to keep track of pressure changes. Gentle tap will show if immediate trend is up or down.

FORECAST: *Dependable Performance with MOBILGREASE AERO*

For Top Flight Performance . . .

Make it Mobil

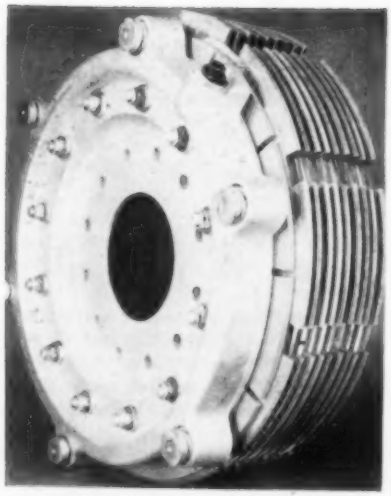
Leader in Lubrication for 90 years

In any weather, wet or dry, hot or cold—quick, accurate control response . . . vital factor to safe flight . . . can be assured by proper lubrication with Mobilgrease Aero.

Mobilgrease Aero General Purpose, with a temperature range of –40°F. to 275°F., is recommended for normal conditions to help assure instantaneous reaction of ailerons, rudder, trim tabs, landing gear and other important controls.

Where low temperature conditions prevail, use Mobilgrease Aero Lo-Temp. It has a temperature range to –65°F. Both of these top-quality Mobil products are approved by leading aircraft manufacturers. Fly weather-wise *with Mobil!*

SOCONY MOBIL OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP., MOBIL OVERSEAS OIL CO., INC.



Simplified Brake

This simplified, lightweight aircraft brake, specified as original equipment on several new commercial and military aircraft, contains about 200 fewer parts than brakes of comparable size and capacity, according to the manufacturer, Aviation Products Div., Goodyear Tire and Rubber Co. The new, disc-type unit also gives up to 50% more heat absorption per pound of weight due to its new friction lining material. Because the brake does not require individual linings, and is simple to assemble and disassemble, maintenance costs are reduced.

Plant to Turn Out Guidance Systems

Minneapolis-Honeywell will build a new $4 million facility for the manufacture of inertial guidance systems at Pinellas County International Airport near St. Petersburg, Fla. The company is the third major avionics company to announce Florida facility plans in recent months. (Sperry-Rand and General Electric are the other two.)

Construction of the new plant will start immediately and production is expected to begin early in 1957. The new facility will provide 208,000 sq. ft. of floor space and is expected to employ 1,500 persons by mid-1957.

Contract for Brooklyn Engineering Center Signed

Polytechnic Institute of Brooklyn signed a contract with W. J. Barney Corp. of New York to coordinate and supervise the conversion of American Safety Razor Corp. plant to a scientific and engineering center for the school.

Brooklyn Polytechnic bought the huge industrial plant in 1954 for $2 million. Estimated cost of the conversion is between $1.5 and $2 million.

Color TV Monitors Redstone's First Moments

Closed-circuit color television has been used successfully to monitor the first few seconds of a Redstone missile launching at the Army site of the Air Forces Missile Test Center at Cape Canaveral, Fla.

Several TV cameras were mounted on top of the firing blockhouse at approximately 100 yds. distant from the launching pad, and were focused on the tail section of the 60-ft. ballistic twin missile.

Monitors inside the blockhouse gave observers a closeup of the flash and flame color during the critical stage of the launching.

Black-and-white TV has long been used in this kind of work. This instance is the first where color, closed-circuit TV has been put to work use. The equipment was standard General Electric units developed at the company's Electronics Park, Syracuse, N. Y.

Japan Builds Jet Engine for Trainer

Tokyo—Japan has built a J3-1 axial flow jet engine, a major step toward manufacture of its own jet planes.

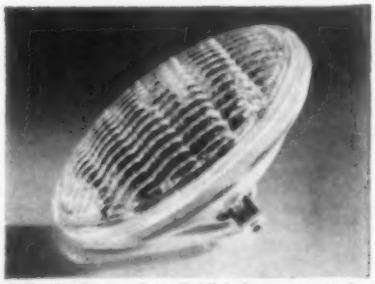
The engine was made by the Japan

New G-E lamp helps keep dark-adapted pilots from "blinding out" when lightning flashes!

Makes instruments easier to see... designed to reduce reflected glare

General Electric's new #4589 Lamp comes to the rescue when pilots suffer temporary loss of night vision. In after-dark flying, a pilot's eyes are adapted to reading instruments and seeing other aircraft. The sudden brightness of lightning can make him "blind out"—creating an acute hazard to himself, his passengers and his aircraft.

Now, in such emergencies, pilots switch on the new General Electric #4589 Lamp and get a light of high intensity—making instruments easy to read. Afterward, lamps are dimmed for pilots to regain dark adaptation. The beam pattern is designed to concentrate light on the instrument panel,



G-E #4589 Lamp—Controlled light for emergency seeing.

thus minimizing reflected glare from windshields, windows and canopies.

This lamp is also used for instrument panel floodlighting in stratosphere flying. Your General Electric Lamp Distributor can provide additional information on this and other G-E lamps for aircraft lighting.

Progress Is Our Most Important Product

GENERAL ELECTRIC

(Advertisement)

Valve Talk

FOR WM. R. WHITTAKER CO., LTD.
BY MARVIN MILES

Fixed prices for equipment repair or re-work save a lot of money.

And for two sound reasons: They reduce the costs involved by fifty percent and they can cut turnaround time in half.

Whittaker instituted flat rates for re-work jobs a year ago and in the intervening months the program has proved a definite success both for the Southern California valve company and for Whittaker customers who have had the foresight to accept the cost/time advantages offered.

Re-work falls into four general classifications: (1) work required under the label of "customer responsibility" because of damage, improper installation, etc.; (2) re-work necessary under vendor responsibility, i.e., improper assembly, failure to meet customer test, etc.; (3) regular overhaul; (4) extensive modification programs where conversion to a revised configuration is required.

Flat rate re-work, of course, applies only to jobs designated customer responsibility. Under vendor responsibility no charge is involved, while overhaul jobs fall within a different category.

The Whittaker flat rate program – like others in the industry – was undertaken to eliminate the costly, time-wasting paper work demanded by re-work orders that require separate price quotations on each job.

Whittaker experts tell me that a $5 re-work order can consume $85 worth of clerical time and pile up more paper work than that required for a 1000-piece order of new valves!

And time wasted in the paper mill is lost not only to Whittaker, but to the customer as well, for widening gaps in smooth delivery flow are hard to fill.

Take a typical example wherein flat rates are not accepted:

After delivery, a mechanic damages a set of valves on the line. He may feel the trouble is "vendor responsibility" and writes it up as such.

The purchasing department of the prime manufacturer has no way of checking, accepts the report and orders the units returned for re-work.

On receipt, the vendor knows immediately the responsibility isn't his and notifies the prime which accepts responsibility and asks for price quotations, thereby setting the paper mill in high gear.

Problem No. One arises when the prime won't order the re-work until he knows the price, while the vendor can't quote until he gets into the re-work.

Then a wide variety of vendor departments become involved in the laborious process – production control, materiel control, planning, scheduling, expediting, transportation, etc. Meanwhile the prime waits impatiently for the re-worked units, with the delay stretched through formulation of a cost breakdown and consideration of the vendor price quotation.

This delay very likely will be stretched even further because the vendor – until he finally receives order approval – cannot plan on parts necessary for the fix or schedule the required production interruption.

The flat rate program carves the re-work system down to a bare minimum. In essence, it involves a careful analysis of all production units on a historical basis – a study in which the primes may take part if they wish – to establish a fair, flat rate for re-work on the basis of past re-work requirements.

Flat rate prices are then meticulously reviewed every six months to keep them equitable.

The beauty of the system is that any prime with acknowledged responsibility for re-work knows the exact price for the job and can order the work done with one piece of paper and little or no follow-up, thereby slashing the time element in half at a proportionate saving in cost.

Here I would like to state that rarely is there any dispute about responsibility. The vendor's analysis of responsibility is almost invariably accepted and while negotiation is necessary occasionally in fine-line cases, there are virtually never any accusations or arguments involved.

Most prime manufacturers have accepted the flat-rate re-work system, agreeing to an average rate of about 50 percent of the original cost. Others still prefer individual quotations, despite the time/cost disadvantages involved, apparently because their auditing departments feel they cannot accept what they erroneously term "blank check" conditions.

Companies that have accepted the plan express enthusiastic approval. Therefore it would appear reasonable and business-like for the skeptics to give flat-rate re-work a try – for their own advantage.

Jet Engine Co. in cooperation with four other companies and was assembled at the Omiya plant of the Fuji Heavy Industries Ltd. Engine will be tested shortly at the Omiya plant. If testing is successful, the engine will be installed in a jet trainer planned by the Defense Agency.

Honeywell Receives Contract for Jet Study

Aeronautical Division of Minneapolis-Honeywell Regulator Co. has received a $250,000 contract from Wright Air Development Command for study of inlet diffuser control methods on turbojet engines.

Phase I portion of contract calls for an 18-month study by Honeywell aerodynamicists on methods to assure maximum pressure recovery as shock waves form ahead of jet engine inlet.

Phase II and III portions of contract are scheduled for later award. Time of program may extend to five years or more, Honeywell says.

Contract calls for determination of inlet control variables; relationship to other systems and controls; consideration of electrical, hydraulic, pneumatic and ram air power sources, simulation of foregoing conditions on Honeywell's analog computer system, and prelim-

Anti-Skid Device

National Airlines is converting its entire fleet of 12 Convair 340s and six newly-acquired 440s to the Decelostat anti-skid device. Small unit mounts in the hub of wheel (see arrow) and automatically prevents skids should braking action be too severe. This, in turn, eliminates flat spots on the tires, increasing their life, and promotes safer, quicker stops on slippery runways. Device, which is integrated into the brake's hydraulic system, was selected after a two year test on one airplane proved that it did the job required and appreciably reduced tire wear. Manufacturer is Industrial Products div., Westinghouse Air Brake Co.

YF-100 Bows Out

Denver—The YF-100, prototype of the North American Super Sabre, made its last trip last week, setting a new speed record of 588.95 mph. for a flight between Los Angeles and Denver.

The aircraft was piloted by Maj. Claude E. Good, USAF representative at the North American plant, prior to its delivery to Lowry AFB where it will be on display at the Air Force Academy. Previous record for the Los Angeles-Denver run was 361 mph., set in 1947 by a propeller-driven A-26.

inary design studies of control systems and power actuation methods.

USAF has awarded Minneapolis-Honeywell Regulator Co. $4.4 million contract to supply more automatic pilot systems for McDonnell Aircraft's F-101A Voodoo.

Contract brings total Honeywell orders for MB-1 autopilot for Voodoo to $10 million. Company also has orders totaling approximately $28 million to supply MB-3 autopilot to North American's F-100D Super Sabre.

Avro, Orenda Buys Government Tools

Toronto—Avro Aircraft Ltd., and Orenda Engines Ltd., Toronto, have bought about $18 million of government-owned machinery and equipment for their factories at Malton, in suburban Toronto.

Avro bought machine tools and equipment for $3.7 million and now owns the entire plant and facilities where CF-100 and CF-105 jet fighters are in production. Orenda Engines Ltd. bought equipment for $13.9 million and now owns virtually all facilities at the plant.

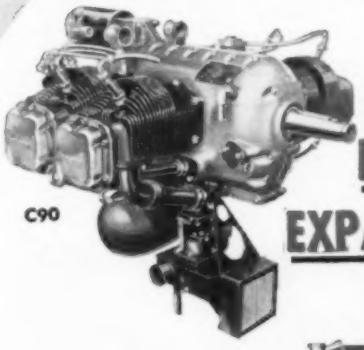
Garrett Develops New CF-105 Heat Exchanger

A new heat exchanger for the cockpit cooling system of Canada's supersonic delta-wing fighter, the CF-105, has been developed by the Garrett Mfg. Corp. of Canada, Ltd. The unit is one of the largest stainless steel components ever manufactured for aircraft use, according to AiResearch Manufacturing division, Los Angeles, producers of the heat exchanger.

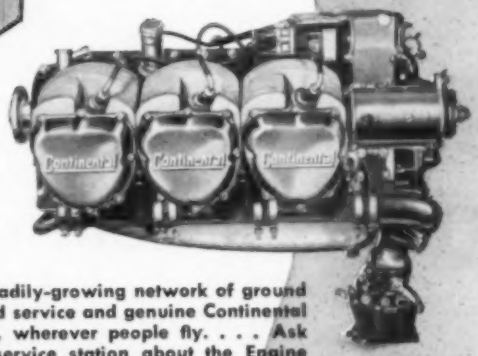
AiResearch says it uses vacuum brazing to make the heat exchanger core to provide completely homogenous bonds and to assure the removal of all impurities, the principal cause of air contamination and leakage.

The heat exchanger is part of the complete air conditioning and pressurization system being made by AiResearch for the CF-105.

CONTINENTAL MEANS DEPENDABLE POWER ... PLUS THE BACKING OF ESTABLISHED AND EXPANDING SERVICE



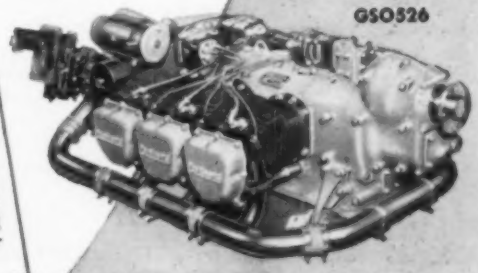
C90



Continental's family of aircraft power plants—65 to 320 hp—is broader and more diversified today than ever before. Continentals give you dependability born of more than 52 years' engine-building experience, and backed by a steadily-growing network of ground facilities—factory-approved service and genuine Continental parts—all over the world, wherever people fly. . . . Ask your Continental Motors service station about the Engine Remanufacturing plan which gives you a new factory remanufactured engine—back to zero hours and with factory new engine guarantee—at low fixed cost, with virtually no dead time.

O470-K

GSO526

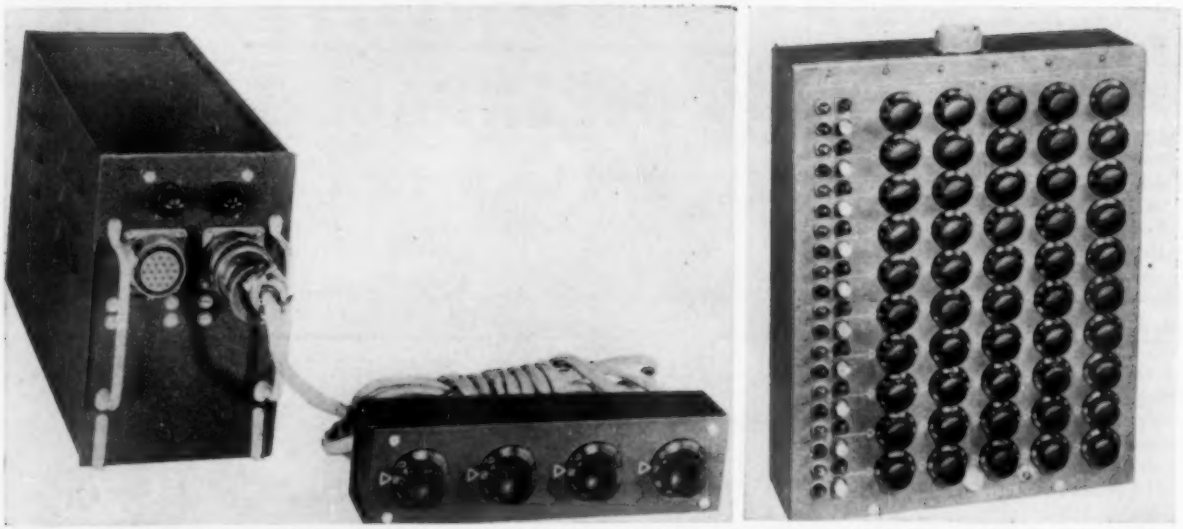


OPPORTUNITIES FOR ENGINEERS
Continental Motors and its subsidiaries have numerous openings for engineering personnel interested in challenging careers in gas turbine and reciprocating engine development. For information, address Engineering Personnel Dept., 12800 Kercheval Ave., Detroit 15, Mich.

	A65	C90	O300	*O470-K	O470-2	FSO470	GSO526
HP	65	95	145	230	265	260	320
RPM	2300	2625	2700	2600	2600	3000	3000
Cyl.	4	4	6	6	6	6	6
Wt.**	170	186.5	311	438	515	565	560
Fuel Octane	73	80	80	80	91/96	91/96	91/96

*Also available in 240-hp version as Model O470-M.
**Engine weight is complete with accessories.

Continental Motors Corporation
AIRCRAFT ENGINE DIVISION
MUSKEGON • MICHIGAN



DUALEX AIRBORNE selective calling system can provide 100,000 or more codes, permits use of airline flight number or airplane registration number, instead of arbitrary alphabetical code which requires master directory. Airborne unit (left) and ground control (right) shown have 10,000 code capacity but can be increased by factor of 10 or more without weight, size penalty.

Dualex Selcal Bid Offers 100,000 Codes

By Philip J. Klass

Dualex, a new type of "sequential" selective calling system, capable of providing 100,000 or more calling codes, is making a strong bid for Air Force adoption as a competitor to the Motorola-developed selcal system now being installed by several airlines.

Two major airlines reportedly share the view held in some USAF quarters that the new sequential type selcal offers greater operational flexibility. The Dualex system can also perform as a poor man's data link. It is manufactured by Bell & Gossett Co., Morton Grove, Ill., under license with the Dualex Corp.

Dualex's increased operational flexibility stems from the fact that it is a digital system and can provide 100,000 or more different codes, compared to the 2,970 codes now available in the Motorola system which was adopted for airline use by Aeronautical Radio, Inc. (Arinc) more than two years ago.

Call Numbers

With the present Arinc selcal system, each airplane is assigned an arbitrary call code. To contact a flight crew, a radio operator must first determine which airplane has been assigned to that flight and its CAA registration number, and then look up in a master directory the call code assigned to that aircraft.

Dualex system, on the other hand, permits assignment of call codes which are identical to the aircraft flight number. Thus a United Air Lines radio operator seeking to call UAL flight No. 600 would merely transmit the number 600, preceded by a two-digit number which identified the airliner as United flight 600, rather than TWA or American flight 600.

From the Air Force's viewpoint, a sequential type selcal provides sufficient codes for its thousands of aircraft and will permit it to assign a numerical call code which corresponds to the last five digits of each airplane's registration number.

A comparison of the principles of operation of Dualex and the Arinc selcal systems provides a better understanding of their features and limitations:

Behind the Name

Dualex Corporation, which has licensed Bell & Gossett Co. to produce its sequential selective calling system and an airborne teletype system employing similar principles, is headed by James Durkee, retired Navy captain who developed the basic technique. The corporation gets its name from the first two letters of the last names of its three owners: James DUrkee, Fred ALbertson, and Carl V. EXselson.

• Motorola/Arinc selcal.

Operates by transmitting two consecutive pulses, each of which contains two tones (frequencies). Twelve different tones, ranging from 312.6 to 977.2 cycles per second, each arbitrarily identified by a letter (A through M) are used to make up the call codes. Thus a call code AG-FL means that tones A and G are transmitted simultaneously for approximately one second, followed by an 0.2 second pause, followed by transmittal of tones F and L.

Call codes normally are assigned to an airplane on a permanent basis by outfitting its airborne selcal receiver with four reeds, each tuned to one of the tones in its assigned code. To change the assigned code requires a change of reeds in the airborne selcal receiver.

• Sequential (Dualex) selcal.

Operates by transmitting a string of consecutive pulse-pairs, with each pulse consisting of a single tone selected from one of seven available. Of the seven tones, two are used only in the first pulse of the pair, while the remaining five are used only in the second pulse. Together the combination can define any number between zero and nine.

To illustrate Dualex operation, assume that each tone is identified by number, i.e., T_1, T_2, . . . T_7. If it is desired to transmit a number between zero and four, the first pulse of the pair will use T_1. If a number between five and nine is to be transmitted, the first pulse will transmit T_2. The second

pulse tone indicates which number in the zero-to-four or five-to-nine group is desired. For example, a pair of pulses consisting of tones T_1 and T_3 might indicate the number Zero. Tones T_1 and T_4 correspond to the number One, tones T_2 and T_3 to number Five.

Two-Digit Transmission

To transmit a two-digit number like 15 it is only necessary to transmit two pulse-pairs in sequence (T_1 and T_4 followed by T_2 and T_3). To indicate a three-digit number, a third pulse-pair is added to the message. In Dualex there is no pause between successive single-tone pulses in a pair, or between pairs. A five digit number is transmitted in about two seconds.

A Bell & Gossett official says there is no theoretical limit to the number of digits that can be added to a selcal message. Each digit increases the number of available codes by a factor of 10. The code capacity of the present Arinc system can be doubled or tripled (to 5,940 or 8,910 codes) by adding another 12 or 24 tones and reeds, but it still falls considerably short of the Dualex capacity.

Poor Man's Data Link

By adding another digit selector on the pilot's Dualex code selector (see photo, p. 70) and two small parts inside the equipment, the number of Dualex codes is increased by a factor of 10, Bell & Gossett says.

By adding one more digit selector than is required to provide the necessary number of codes, and a small function control unit, Dualex can serve as a ground-air data link system. This enables the ground radio operator to transmit up to nine different instructions, questions, or command controls. For example: "What is your altitude," or "What is your estimated arrival time?"

If a ground controller wanted a report on the altitude of American Airlines flight 215, it could address a six-digit message to the airplane. The first two digits would identify the plane as American, the next three digits would be "215" and the last digit would light an indicating lamp marked "Report Altitude."

This data link feature also could be used in connection with the air traffic control transponder to enable a ground controller to select automatically the particular code which the transponder transmits.

Other Advantages

Bell & Gossett officials report that recent USAF tests have confirmed other theoretical advantages of the sequential type selcal system, including:

• **More powerful:** In the sequential system full power (100% modulation) can be applied to the single tone instead of being split between two tones as in the Motorola system.

• **No false triggering:** Approximately half (1,438) of the present 2,970 Arinc selcal codes are, theoretically at least, subject to possible false triggering from intermodulation created harmonics. The use of single tone transmissions in the sequential system eliminates this problem, Bell & Gossett officials report.

Weighs 22 lb.

The airborne Dualex unit, with dual channels and 100,000 code capability, weighs about 22 lb. including the digital selectors which enable the pilot to set up any desired call code. This compares with a weight of about 13 lb. for the Arinc unit. Both come in short ½ ATR size cases. Dualex airborne unit is completely transistorized.

Dualex system has been advanced by Bell & Gossett at a time when several U. S. airlines, including Pan American, United and Delta, are heavily committed to the Arinc system. Several avionics manufacturers, including Motorola, Collins and Bendix Radio, are in the same boat.

If the Air Force should adopt the new sequential type selcal, and there are indications that it might, the move could affect the airline selcal program. Under the Civil Reserve Air Fleet (CRAF) program, a sizable number of airliners are outfitted to permit their immediate transfer to the Military Air Transport Service (MATS) in event of national emergency. If these aircraft were outfitted for sequential type selcal, some airlines might decide to adopt it for fleetwide use, a spokesman for American Airlines says.

However, for the moment, Arinc spokesmen say they have no plans to switch horses midstream.

SKYSCREEN CENTER background projects position of radar tracked aircraft on easily-read screen at left. Old method of plotting with use of vertical transparent board is shown at right. Demonstration showed Skyscreen faster and more accurate.

Skyscreen Plotting System Shown

Compton, Calif.—Skyscreen, Northrop Aircraft Anaheim Division's optical radar plotting system, in a demonstration recently plotted all air traffic in the Los Angeles basin. The show was put on for a group of military and CAA officials. The CAA has evinced interest in Skyscreen's possible applications for en route and close-in air traffic control.

The demonstration was held in the Air Direction Center of the California Air National Guard's 148th Aircraft Control and Warning Sqdn. As Skyscreen (AW Jan. 9 p. 49) projected aircraft positions on its translucent area map, a conventional radar console-to-transparent screen via operators and telephone plot was made simultaneously.

Operating Skyscreen were three ANG airmen, checked out on the device in 30 min. prior to the demonstration,

NORTH AMERICAN'S
Columbus Division

Provides OHIO Opportunities For Experienced ENGINEERS

In Columbus, thousands of professional people have found a city that satisfies an educated way of life. Columbus offers fine centers of learning and cultural opportunities.

At North American's Columbus Division, many of these people work on the completely sufficient, young but proved engineering team dedicated to one of aviation's greatest challenges—the design, development and manufacture of North American's Naval airplanes.

The highly regarded FJ-4 FURY JET is a "concept-to-flight" Columbus Division product, and stability from association with North American Aviation, the company that has built more airplanes than any other in the world . . . compose a career opportunity worth investigation by any engineer:

A SELECT FEW POSITIONS ARE OPEN IN EACH OF THESE FIELDS:

Aerodynamicists, Thermodynamicists, Dynamicists, Stress Engineers, Structural Test Engineers, Flight Test Engineers, Mechanical and Structural Designers, Electrical and Electronic Engineers, Wind Tunnel Model Designers and Builders, Power Plant Engineers, Research and Development Engineers, Weights Engineers.

For the Full Story On Your Ohio Future, Write Today: Mr. J. H. Papin, Personnel Manager, Depart. 56AW. North American's Columbus Division, Columbus 16, Ohio.

Engineering Ahead for a Better Tomorrow

NORTH AMERICAN AVIATION, INC.

COLUMBUS DIVISION

while a trained team of six men operated the present system.

Heart of Skyscreen is Rayfax, a presentation system involving a cathode ray tube which can accept radar beam and data from any distance by any means of communication which can carry human voice, HF, VHF, UHF radio or land telephone lines.

The CRT, a 16-in. model, is in the head of the Skyscreen. The radar beam sweep, blips and clutter are projected downward through a beam splitter onto a lense. The beam splitter eliminates the local geographic clutter from mountains, buildings, etc. It leaves the airplane echo pass on to a lense where the operators can place a specially designed glass chip on the echo projection. This chip gives airplane data by its color, which is projected onto the screen by its direction and a series of numbers and dots.

Northrop thinking on Skyscreen's air traffic operations is that a large control center, with a translucent map of the area under the particular center's control, could make use of a number of radars placed along airways, each radar having its Skyscreen projector. With a number of operators moving chips at each Skyscreen, and Skyscreens covering the entire airways route system, every plane in the control center's cognizance would be seen easily on the large area map.

Provisions can be made for added information transfer to the screen, such as height finder radar presentations on scales above the map, either by another chip or symbolically.

Other Systems Studied

Marriages between the Skyscreen projection system and various other avionic traffic control systems have been under study by Northrop and the military. Presently, it is envisioned that Charactron tube presentations as used in SAGE can be successfully projected, the characters being replaced by additional information presentations on the marker chips. Northrop engineers also see no reason why other avionic presentations cannot be married to Skyscreen projection of problems of data transmission from radar to Skyscreen tube.

Reason for the Rayfax installation is that current users of Skyscreen are military installations where the unit's portability counts. Some 60 have been delivered to USAF, with the Navy now installing one at Norfolk, Va. An earlier unit had been borrowed by the Navy and installed at Chesapeake Bay, for evaluation.

Skyscreen's radar pickup also hooks up early warning radar planes to Air Direction Centers, again through Rayfax' ability to transmit its data over varied channels.

WARM WELCOME

STEWART SW WARNER ELECTRONICS

a Division of Stewart-Warner Corporation
1300 No. Kostner Ave., Chicago 51, Ill.

Stewart-Warner Electronics today detects the presence of high-performance aircraft, identifies it as friend or foe and can provide a warm missile welcome in an instant.

Research and development at Stewart-Warner Electronics have produced these advanced systems. The program is still expanding, as are the opportunities for the exceptionally well-qualified engineer.

Today as yesterday, Stewart-Warner Electronics safeguards our skies with tomorrow's planning and production.

MICRO precision switches

...THEIR USE IS A PRINCIPLE OF GOOD DESIGN

HONEYWELL

This "Electrical Memory" switch is a completely new concept in switching remotely controlled circuits

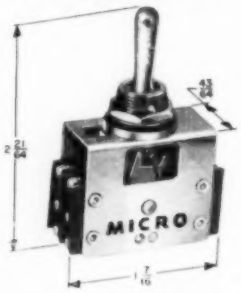
Here is the first in a new series of "electrical memory" toggle switches. It is designed to provide electrical indication while putting information into computers where it is necessary to know which circuits were last energized.

This new MICRO SWITCH switch assembly will simplify and revolutionize some basic circuit designs of complicated aircraft control panels, airborne and other computer devices, ground radar units and other types of remote control equipment.

This new switch is typical of the manner in which MICRO SWITCH engineering, a pioneer in the precision switch field, has been meeting unusual aircraft design requirements for almost two decades. In the long MICRO SWITCH line are many switches and assemblies which have been designed for multiple circuit control, resistance to high temperatures or sealed against environmental changes and exposures.

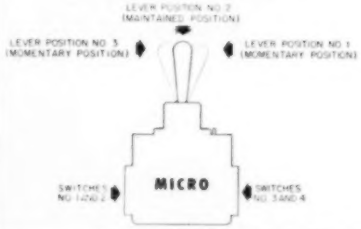
Whatever you want in a precision switch, MICRO SWITCH can supply it —with a reliability and long-life performance in keeping with rigid aircraft requirements. MICRO SWITCH engineering service is at your nearby branch office—as close as your phone.

Four subminiature switches in "Electrical Memory" Toggle Switch



• The assembly uses three single-pole double-throw subminiature switches and one single-pole double-throw subminiature "memory switch."

How switch is operated


LEVER POSITION NO. 2 (MAINTAINED POSITION)
LEVER POSITION NO. 3 (MOMENTARY POSITION)
LEVER POSITION NO. 1 (MOMENTARY POSITION)
MICRO
SWITCHES NO. 1 AND 2
SWITCHES NO. 3 AND 4

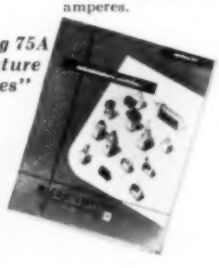
	Lever Position No. 1	Lever Position No. 2	Lever Position No. 3
Switch No. 1	N.O. To C. Circuit Made	N.C. To C. Circuit Made	N.C. To C. Circuit Made
Switch No. 2	N.O. To C. Circuit Made	N.C. To C. Circuit Made	N.C. To C. Circuit Made
Switch No. 3	N.C. To C. Circuit Made	N.C. To C. Circuit Made	N.O. To C. Circuit Made
Switch No. 4	N.C. To C. Circuit Made	*	N.O. To C. Circuit Made

*N.C. To C. Circuit Made if Lever Last Moved To Lever Position No. 1
*N.O. To C. Circuit Made if Lever Last Moved To Lever Position No. 3

Electric rating of basic switches

The precision basic subminiature switches used in the assembly are listed by Underwriters' Laboratories at 5 amperes 125 or 250 volts a-c. Their d-c rating at 28 volts is: inductive—3 amperes at sea level and 2.5 amperes at 50,000 feet; resistive —4 amperes at sea level and 4 amperes at 50,000 feet. Maximum inrush is 15 amperes.

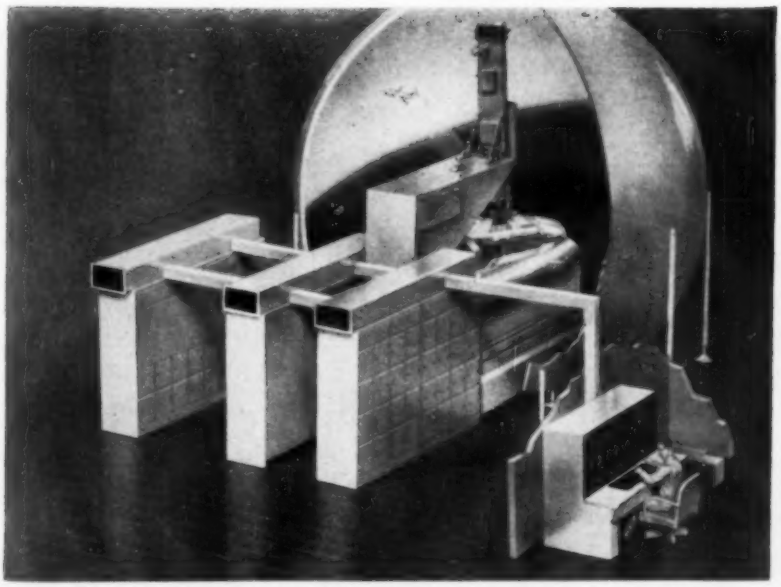
Send for Catalog 75A "Subminiature Switches"

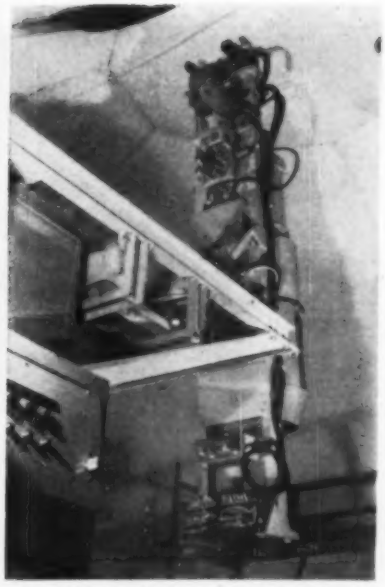


MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS





SIMULATOR (left) with F-151 Visual Fixed Aerial Gunnery Trainer. Target is on screen at upper left of cockpit, operator is at console lower right. Foreground cabinets contain electro mechanical analog computers which perform computation of target position and attitude relative to student. Mechanism (right) projects horizon target.

Gunnery Trainer Attaches to Simulator

A new flexible aerial gunnery trainer, employing a television pickup and projection system, can be attached to any modern flight simulator. Developed by the Rheem Manufacturing Co., the system projects a target image on the inside of a large spherical screen surrounding the simulator cockpit. Visible horizon is established by a hemispherical projector mounted at the top of the sphere.

Directed by intersystem computors, the trainer converts aircraft instrument signals from the flight simulator into a visual display containing air and ground targets and sky and earth effects. Exact spatial geometric relationships between fighter aircraft and target are depicted.

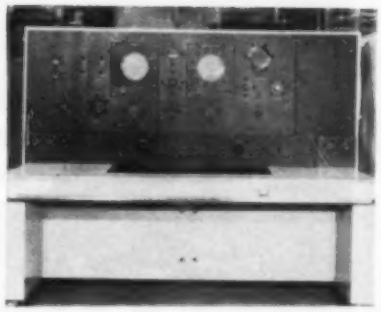
The trainer contains a complete weapons scoring system designed to accommodate present and future fire control systems for gunnery, rocketry and bombing. Dynamic inputs from the flight simulator enable the computing sight system to track the projected target image; the built-in scoring devices automatically register the tracking and firing proficiency of the pilot.

Immediate detection and correction of errors in tactics or operating procedure is available at the instructor's console, resulting in a high-transfer of learning from instructor to student. The console contains trainer operating controls, target course generator controls, system calibration check controls and an interphone system for communication with the student. It indicates sighting and ranging accuracy, triggering time, rounds fired, number of hits, and other data needed for instant evaluation. Except for such factors as vibration and acceleration forces, the system closely simulates true flight conditions.

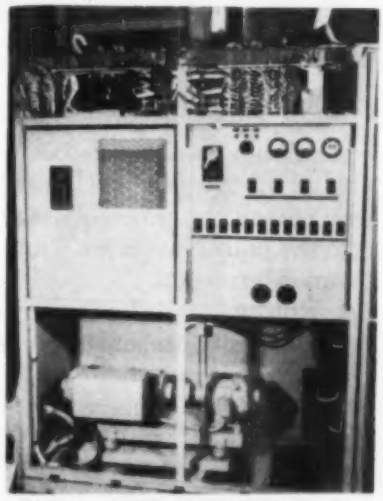
The system, called the F-151 Visual Fixed Aerial Gunnery Trainer, can be attached to any modern flight simulator with minor modifications. These mainly are confined to installation of data pick-off devices on certain computer elements. Any fire control system which operates from dynamic forces produced by the aircraft and/or space measurements produced by radar, can be employed in the system, assuming compatibility with the chosen simulator cockpit arrangement. Radar and visual data will correspond in space position at all times because the source of target position data is common to both.

Need for a visual simulation device for training fighter pilots in the operational use of disturbed reticle type gunsight was established by the Air Force Operational Service back in 1948. In 1950, Wright Air Development Center prepared a comprehensive specification covering the technical requirements of such a device. Soon afterward Rheem was awarded a contract to develop the fixed gunnery trainer under the technical direction of WADC.

The trainer originally was planned as



CONSOLE duplicates all cockpit instruments.



POWER control panel of F-151 trainer.

When all the shouting is over and the last campaign speech has been made, isn't this what all the struggle is really about?

You and your neighbors are going to march to the polls November 6 and settle things the American way.

Not by fists or by force, not with a penalty if you don't vote, or the secret police checking up to see if you did.

You'll vote because it's the thing to do.

Vote as you please, of course—but vote.

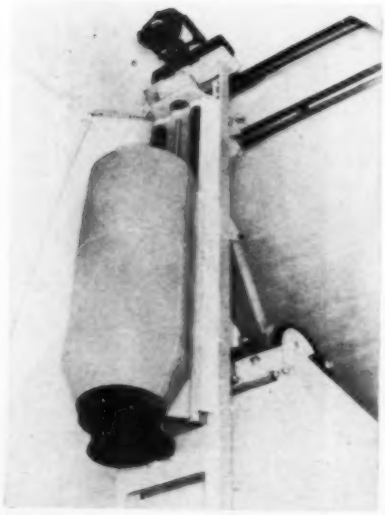
Vote for the party and the candidates you honestly believe will represent you best.

But also vote because you believe in this democracy of ours and you want to keep it the way it is—a country where you can have your say and nobody else can say it for you.

Everybody you know will be there.

We'll see you at the polls.

VOTE NOVEMBER 6th!



PROJECTOR employs 80,000-volt television tube to project target on spherical screen.

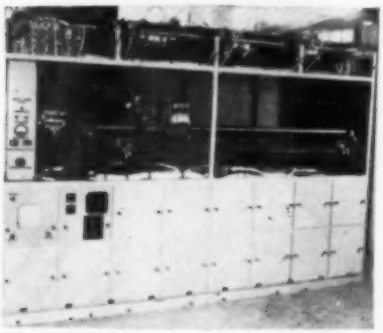
a completely integrated system containing, in addition to visual elements, a minimum simulation cockpit and aerodynamic computers of simple nature. This trainer was intended to simulate typical pursuit path gunnery attacks only, without concern for other phases of aerial combat. But as the program progressed it became apparent that the usefulness of both the flight simulators and the gunnery trainer would be enhanced if the trainer were designed as a visual attachment for modern training systems. The engineering model of the F-151 trainer thus was based upon flexibility of new design concept.

After evaluation tests at Nellis Air Force Base at Las Vegas, a production contract for the F-151 was issued to Rheem in January 1956. The trainers are visual attachment devices designed specifically for connection to the MB-3 (F-100) Flight Simulator in production by Melpar, Inc., of Alexandria, Va., and the Union Switch and Signal Co. of Swissvale, Pa.

Rheem is a manufacturer experienced in military development programs centered about general simulation of in-flight conditions. During the development of the F-151, Rheem conducted a study program which established preliminary design parameters for fighter vs. fighter training.

Other Rheem projects:

- A visual reconnaissance trainer design concept embodying reflected light projection system which presents a full color image from a three-dimensional terrain map.
- A comprehensive visual trainer capable of presenting visual effects of take-off, traffic pattern navigation and landing.
- A synthesized radar sighting unit for APG-41B radar equipment.



TELEVISION pickup unit, brains of which is Du Mont Vidicon pick-up camera extreme left of cabinet.

Beekman Receives Instrument Contract

Dallas, Tex.—Beekman Instruments, Inc., of Richmond, Calif., received a contract to install a $131,310 data-handling system in the Chance Vought Aaircraft, Inc., new $3,820,000 supersonic wind tunnel.

Contract provides for installing instruments which will measure and record data from model planes and missiles mounted in the 3,800 mph facility. Chicago Bridge & Iron Co. recently won the contract for constructing the tunnel for $2,868,000.

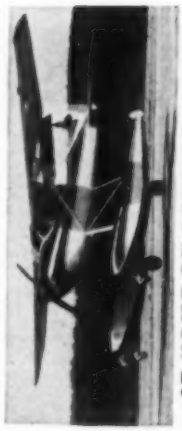
BIG or SMALL they all SHINE BEST SHINE LONGER SHINE EASIER with

NEVR-DULL
Aluminum Cleaner and Polish

The original chemically-impregnated cotton wadding — Cleans quicker, gives higher, longer-lasting gloss, leaves protective film. Saves time, labor and money! Avoid inferior imitations.

AVAILABLE AT LEADING DISTRIBUTORS

MANUFACTURED EXCLUSIVELY BY
George BASCH Co.
559 Longfellow Avenue, New York 59, N. Y.



AT HOME ON LAND OR WATER

The Perfect Amphibian...

CESSNA 180 ON Edo FLOATS

Your Cessna 180 on Edo amphibious floats gives you great new utility you never dreamed possible before. Suddenly, you have a million landing places—every lake, harbor, river, plus regular airports.

And you get such wonderful performance with the Edo 180...over 135 mph cruise, fast take-off from water, the nicest handling characteristics on land. At last a really nimble amphibian!

Investigate how Edo amphibious floats will improve the usefulness of your Cessna 180. They're easy to install, easy to remove during seasons when water operations may not be desired. Available for prompt delivery. See your Cessna distributor or write for float brochure.

Standard Edo floats available for all single engine Pipers, Cessnas and many other types.

Edo Model 289 amphibious floats feature retractable, wide-tread, four-wheel gear each with long-travel oleo struts. Surprisingly little weight penalty.

EDO CORPORATION • College Point, L.I., N.Y. *Fine Floats since 1925*

Collins

new airborne electronic system

Engineered for those customers who require the finest equipment obtainable —Collins new Airborne Electronic System is as advanced as the Jet Age. A complete package installation in communication, navigation and control is *Lightweight*—savings up to 65%, *Compact*—volume reductions of up to 60%, *Efficient*—power reductions of 50% or more, and *Modularized*—for complete flexibility on any multi-engined aircraft—piston or jet.

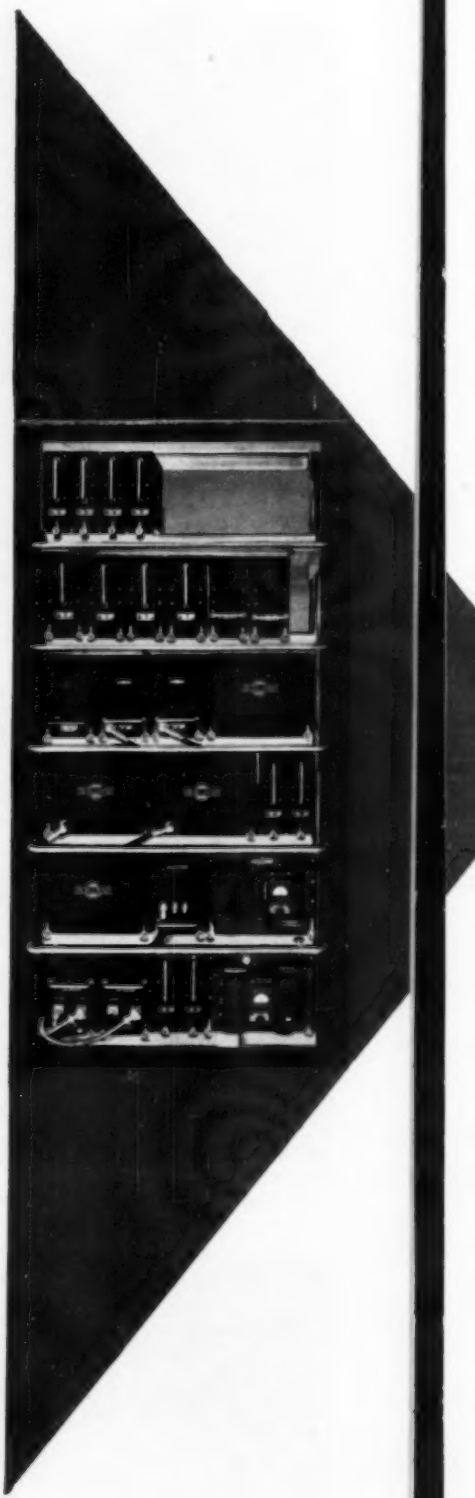
more reliable

less weight

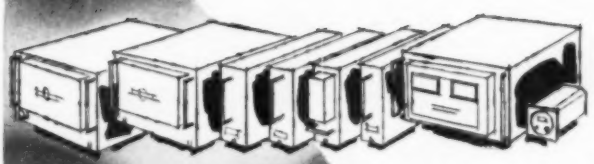
more compact

less power

more flexible

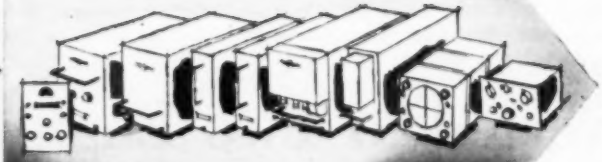


Top Shelf: Dual Integrated Flight System; 2nd shelf: dual VHF Xmtrs and Rcvrs, dual Selcal; 3rd shelf: Automatic Pilot, dual VOR/LOC Rcvrs, SSB HF Rcvr; 4th shelf: dual SSB HF Xmtr, dual Glideslope Rcvrs; 5th shelf: second SSB HF Rcvr, ATC Beacon Transponder, Radar Synchronizer; Bottom shelf: dual ADF, Interphone Amplifier, Marker Rcvr, and R/T of Radar.



COMMUNICATION

Only Collins offers such a complete line of communication equipment—VHF, HF, HF SSB, Interphone and Selcal. Modularized, transistorized, each with an integral, removable power supply. The latest unit, the Collins new SSB 1 KW transmitter-receiver, will set the new standard in global operations.

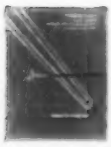


NAVIGATION

Collins, as always, the leader in navigation equipment, brings this new package which includes ADF, VOR receiver and instrumentation, ATC Beacon Transponder, Marker and Glideslope Receivers, and Weather Radar. Representative of the new lightweight navigation equipment is the 15 pound ADF Receiver built to ARINC Characteristic 530A.

CONTROL

Using Collins control package, smooth, precise, flight control is achieved with Collins tubeless, modularized Automatic Pilot. Outstanding instrumentation is provided by Collins Integrated Flight System—the original; the IFS also gives excellent manual flight control.



Call the nearest sales office for information, or write for the new Airborne Electronic System brochure.

Collins CREATIVE LEADER IN AVIATION ELECTRONICS

COLLINS

COLLINS RADIO COMPANY, 855 2ND AVE., S.E., CEDAR RAPIDS, IOWA; 1930 HI-LINE DRIVE, DALLAS 2; 2700 W. OLIVE AVE., BURBANK; 261 MADISON AVE., NEW YORK 16; 1200 18TH ST. N.W., WASHINGTON, D.C.; 4471 N.W. 36TH ST., MIAMI 42; 1310 4TH AVE., SEATTLE. COLLINS RADIO COMPANY OF CANADA, LTD., 11 BERMONDSEY ROAD, TORONTO 16, ONTARIO • COLLINS RADIO COMPANY OF ENGLAND, LTD., SUNFLEX WORKS, COLHAM MILL ROAD, WEST DRAYTON, MIDDLESEX.

FAIRED nose and thin nacelles characterize conversion of single engine Beech Bonanza by David G. Peterson, Tulsa, Okla., who is standing at cabin entrance of the twin engine model. Single-engine model is in background. Conversion uses two Lycoming P-340 engines, rated at 170 hp., but engines are inverted and have fuel injection. Air intakes, which take advantage of ram effect, are on top of nacelles, two to each engine. No tail modifications were made, but wing structure was strengthened.

Bonanza 35 Converted to Two Engines

By William Gregory

Conversion of a single-engine Beech Bonanza 35 to a twin engine model using fuel injection, and a 14-in. high nacelle with an exhaust system designed to add to lift and a gross weight only 200-250 lb. over the single engine model, is offered commercially by David G. Peterson of Tulsa, Okla.

"There are about 5,000 Bonanza owners," Peterson said, "and if I can get 15-20% of them interested in conversion I think I can get the cost down to around $15,000."

Figures Tentative

Peterson's experimental conversion model has made a dozen test flights, and these are the basis of the figures Peterson quoted. They are still tentative, he emphasized.

"A lot of people around the airport thought I was crazy to fly a twin-engine plane without a rudder," Peterson said, "but it handled as well as any plane with the usual tail. What I've got are two rudders."

Peterson found in test flights that with the left engine, the critical engine, feathered and the right engine at full power, stalling speed was 62 mph. This was with 40 gal. of fuel and only himself in the cockpit.

At what he expects will be full gross weight—3,100-3,200 lb.—Peterson said single-engine stalling speed would be about 68 mph. This would include the addition of two 30 gal. fuel tanks outboard of the nacelles, as either integral wing tank or tip tanks. Peterson has not decided which.

Lift Gained

Part of the reason for the good single-engine performance of the conversion, Peterson believes, is the lift gained not only from the thin nacelle, but also the placement of the exhaust on top of the nacelle well forward on the wing, providing some thrust augmentation and a form of boundary layer control.

Few structural modifications were made in the experimental model, none to the tail. Web of the wing spar was extended from the wheel well out to the tip to carry the increased fuel load. The wing was beefed up to carry the nacelle, which is on a standard tubular mount.

First 18 in. of the nose cone is Fibreglas, and Peterson would like to use Fibreglas all the way to the firewall because of its economy.

By removing the Bonanza's single Continental engine, which was 185 hp. in the 1947 model converted, Peterson saved 550 lb. fuselage weight. Because of the weight distribution with fuel added in the wings, this weight cannot be replaced in the fuselage in the form of baggage.

The conversion allows 150 lb. for luggage and radio and electronic gear in the nose.

The two O340 Lycoming engines rated at 170 hp., which replace the Continental weigh about 700 lb. total. This, with the extra fuel, accounts for the difference in gross with the Bonanza single engine—2,775 lb. power loading is 9.4 lb./hp. and perhaps less if the engines are gaining power from fuel injection.

Peterson is not committed necessarily to a Lycoming engine. Another Continental would be as suitable, he said, and he would prefer whichever manufacturer would agree to supply him the engine with the fuel injection modifications already made.

Ram Effect

Not a great deal of engine modification was necessary for the fuel injection system, Peterson said. The equipment is furnished by Simmonds Aerocessories, Inc., Tarrytown, N. Y. And the nozzles are placed in the intake ports of the cylinders.

Air is caught by two forward facing scoops on each side of the nacelle top. This has the advantage of a ram effect from the propeller wash and airflow.

Some added horsepower may be

gained by using the injection system. Peterson has not tested the engines with a dynamometer, but he has found that in full low pitch the engines rated at a maximum 2,700 rpm. will turn 2,900 rpm.

Carburetor Eliminated

Elimination of the carburetor trimmed six inches from nacelle height, and gaining an efficient, thin airfoil shape from the nacelle was a major reason why Peterson chose fuel injection. Dropping the oil pan and shifting from a wet to a dry sump also saved nacelle height. The nacelles are about two-thirds the height of those on the Cessna 310, which itself gains 12% of its total lift from the aerodynamic nacelles.

To put both air intake exhaust on top of the nacelle, Peterson has inverted the engines. This eliminates a possible fire hazard in removing the exhaust from the engine bottom, and it also reduces the engine heating problem.

Fuel consumption of the conversion, which will be called the Super V, is about 15 gal./hr. at economy cruise at 12,000 ft. Peterson said.

Duration of 6½ hr. would provide a range approaching one-stop transcontinental.

Top speed is estimated at 220 mph. Cruising speed, Peterson said, would lie between the Twin-Bonanza model C50 and the Cessna 310, or around 200 mph.

Peterson is chief pilot of the Sinclair Oil Co. He has taken a year's leave of absence to handle the conversion project, and has formed a firm called the Sky Line Manufacturing Co., in Tulsa to do the work.

Peterson is sending letters to Bonanza owners to sound them out on conversion.

U. S. BUSINESS & UTILITY AIRCRAFT SHIPMENTS

(January—June 1956)

	Aircraft		Builder's Net Billing Price	
	June	Jan.-May Total	June	Jan.-May Total
Aero Design 560-A	2	30	993,000	$3,603,700
680	12	18		
Beech Bonanza	46	220		
Super 18	8	45		
D18S	0	6	2,489,602	12,984,566
Twin-Bonanza	10	57		
Model 45 Trainer	45	5		
Callair A-4	2	9	10,991	38,621
Camair 480 Twin-Navion	2	9	58,000	235,450
Cessna 170	4	61		
172	111	743		
180	25	316	3,464,222.50	[1]17,412,343.85
182	134	351		
310	18	106		
Champion 7EC	19	78	70,800	304,478.46
Helio H-391B Courier	2	12	46,000	277,000
Lear Learstar Mk. 1	1	3	640,000	1,200,000
Learstar Mk. 2	1	0		
Mooney M18C	0	7	79,000	264,873.65
M20	8	24		
Piper Super Cub PA-18	14	97		
Super Cub PA-18A	45	241	2,016,482.65	10,142,887.19
Tri-Pacer	104	554		
Apache PA-23	37	182		
Royal Gull P-136L	1	7	74,500	521,500
Taylorcraft Model 20	4	15	20,000	140,153.80
Totals	653	[1]3,186	$9,916,598.15	[1]$47,125,573.95

Includes sales of five factory-owned Model 195s and 2 agricultural versions of L-19. Source: Compiled by AVIATION WEEK. Previous tabulations for 1956: AW July 9, p. 84; AW May 28, p. 101; AW May 7, p. 103; AW Apr. 2, p. 67; AW Mar. 19, p. 63.

CHR NEWS

Sealing Republic's drag chute

by Arnold Dessel
CHR New Haven

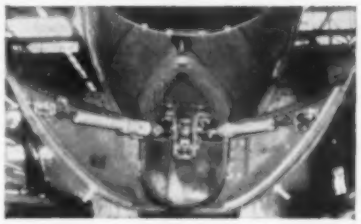
The Connecticut Hard Rubber Co.

Packing a retrofit drag chute into existing F-84 aircraft was a tricky design problem for Republic Aviation Corporation. Many F-84's have already received this successful modification, however. The addition cuts 1000 feet from the landing roll of the plane without effecting either speed or performance in flight. Cooperating with Republic engineers, our company helped work out the sealing system for the drag chute assembly doors.

Basically, sealing the doors was a matter of sealing against water, dirt and ice in temperatures —100° to 250°F. Correct seal design would also keep a clean aerodynamic line and release without sticking. In addition, constant replacement due to ozone and weather cracking was undesirable. There was no doubt that silicone rubber was required. Selecting out compounds and shapes was our contribution to the program.

At the mold line, where the clamshell doors meet the fuselage, a soft silicone sponge rubber extrusion effects an excellent seal. This closed cell material does not absorb water and is flexible from —100°F to 400°F. For the outside edge of each door we recommended Cohrlastic HT silicone rubber which has twice the tear and abrasion resistance of commercial compounds. This is a simple P-shape extrusion with a silicone sponge rubber core added to beef up the sealing action.

Call on us with your sealing and heating problems



I call on my aircraft accounts on Long Island and in New Jersey once or twice a week. Our other field men covering the aircraft industry in New England, the South, Southwest, Midwest and West Coast give the same intensive coverage to their accounts. Our offices are listed below and if you have a problem in sealing, de-icing, anti-icing, coated fabrics for seals or diaphrams, we are prepared to give you our immediate attention and work out the solution with you as we did with Republic. May we hear from you soon?

SEALS • HEATERS
SILICONE RUBBER PRODUCTS
Sheet Sponge Coated Fabrics
Extrusions Moldings

CHR THE CONNECTICUT HARD RUBBER CO.
407 EAST STREET • NEW HAVEN • CONN.
SPruce 7-3631
Los Angeles St. Louis Seattle

ALUMINUM Company of America DC-3, with nose radome, was given a custom interior designed by Harley Earl, Inc., Detroit. Piedmont Aviation, Winston-Salem, N. C., did conversion. It includes latest in radio and radar gear and new uses of aluminum in interior.

Aluminum Dominates Alcoa DC-3 Interior

FLIGHT deck cabin was opened up by establishing a counter (left) and putting radio equipment below. Instrument panel, with radar eyepiece at center, is black anodized aluminum. Markings are etched in the natural metal color, and engine control knobs have been anodized in different bright colors for identification. Club seat is for passenger to watch crew. Galley (right) is in the flight compartment and fabricated of aluminum. Work surface is white plastic with extruded aluminum edge. Sink is natural finish aluminum. Lower doors are anodized black; upper areas are finished in a gold textured sheet. Glasses, china have Alcoa symbol marking.

Plane Builds Business Piper Survey Shows

A definite picture of the value of airplanes to the business man is provided by a recent survey of Piper owners by the Lock Haven, Pa., business plane manufacturer.

Briefly the survey indicates:

- **Some 85% of Tri-Pacer owners** say that their business has expanded as a direct result of their having an airplane.
- **Increased business** is reported by 54.5% of twin-engine Apache owners.

Returns from the Piper plane users show that 95.7% of Tri-Pacer owners consider their airplane a "must" and expect to continue to own an airplane in the future. A full 100% of the Apache owners agree on the essential role played by their planes, indicating the continued solid future of this market for business aircraft manufacturers.

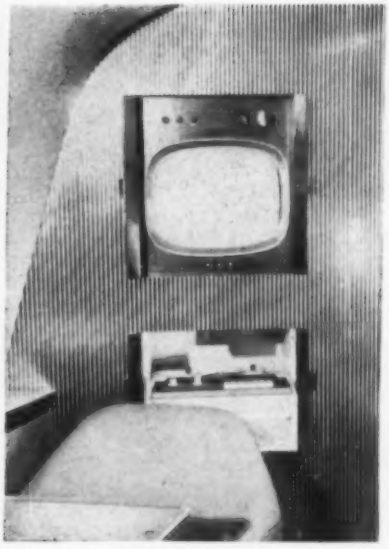
A valuable picture of the background of the average owner of a Tri-Pacer or an Apache is provided by studying replies to the questionnaires collected by the factory.

The average Tri-Pacer owner has flown 1,681 hr., accumulates 317 hr. a year.

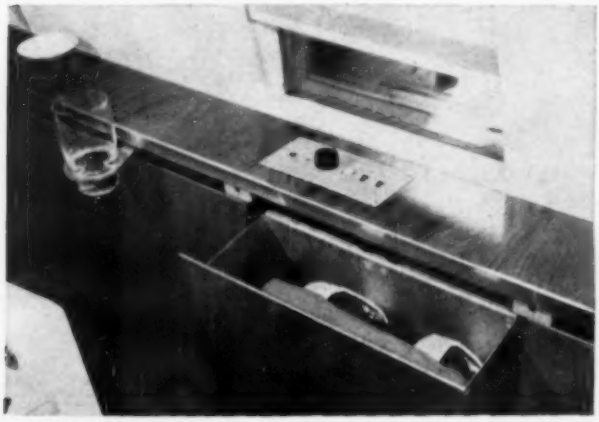
The study shows that 72.8% of Tri-Pacer owners have their airplanes outfitted as Super Custom models with a complete line of communications and navigation equipment. Since purchasing his airplane the owner travels very little via airlines or on railroads, his total time being divided 50-50 between his plane and automobile. The airplane gives him an average of 14 miles to the gallon, a favorable comparison, costwise, with the car.

Tri-Pacer owners are divided thus: Manufacturers, 19.5%; ranchers and farmers, 10.3%; doctors, 9.1%; airport operators, 9.1%; contractors, 7.9%; wholesalers, 5.5% real estate and insurance firms, 3.9%; retail stores, 3.6%; automobile dealers, 3.6%; salesmen, 3.5%; engineers, 3.3%; oil field workers, 2.1% and missionaries and other church workers, 1.8%. The remaining 16.8% of Tri-pacer operators cover a wide range of business and professional interests and also include government agencies, flying clubs, sportsmen, housewives and retired couples.

The average Apache owner has logged



PASSENGER cabin has seats upholstered with Trilok designed by Harvey Earl for U. S. Rubber Co. Metallic thread of aluminum is woven into design. Sofa and lounge chairs are gold, with aluminum flecks, club chairs red. Headlining is white, carpet black. Woven aluminum wire panel, which is to left of plain panel of aluminum sheet with Alcoa symbol cut-out, was produced by Tyler Products, Cleveland, Ohio, and is anodized gold with natural high lights polished. Rear bulkhead (right) has television set and tape recorder inset in aluminum sheet with rolled stripe texture. Recessed stripe is black, top surface is polished bright aluminum.



RETRACTABLE glass holders, tilt-out aluminum bins, sockets for auxiliary tables, are under rosewood counter top at window, which has built-in shade. Gold anodized aluminum extrusion trims shade and edges counter top. Face panels are of textured aluminum sheet. Lavatory counter top is gold anodized sheet, mirror is aluminum Alzak sheet. Full length mirror of same material is on back of door.

4,091 hr. and puts 505 hr. a year on his airplane. Commercial licenses are held by 59% of Apache owners, the remainder being private pilots.

Costs of their twin compares favorably with auto costs, 58.6% of Apache owners report. Breakdown by occupation of owners of this twin: Manufacturers and executives, 36.2%; contractors, 13%; oil field workers, 8.7%; real estate and insurance firms, 5.8%; business distributors, 4.3%; lumbermen, 2.9%; advertising agencies, 2.9%; airport operators, 1.5%; dairymen, 1.5% and doctors, 1.4%. The remaining 11.8% have similar wide range of interests as recorded for Tri-Pacer owners. Only 4% of Apache owners said that they do not use their airplanes on business.

PRIVATE LINES

Scheduled escorted air tours for private pilots to Mexico start Oct. 21, departing from Rio Grande Valley International Airport, Brownesville, Tex. Current tours are planned for Oct. 21, Nov. 17, Dec. 8, Jan. 12, Feb. 16 and Mar. 16. Write Aviation Travel Service at Rio Grande Valley International Airport for details.

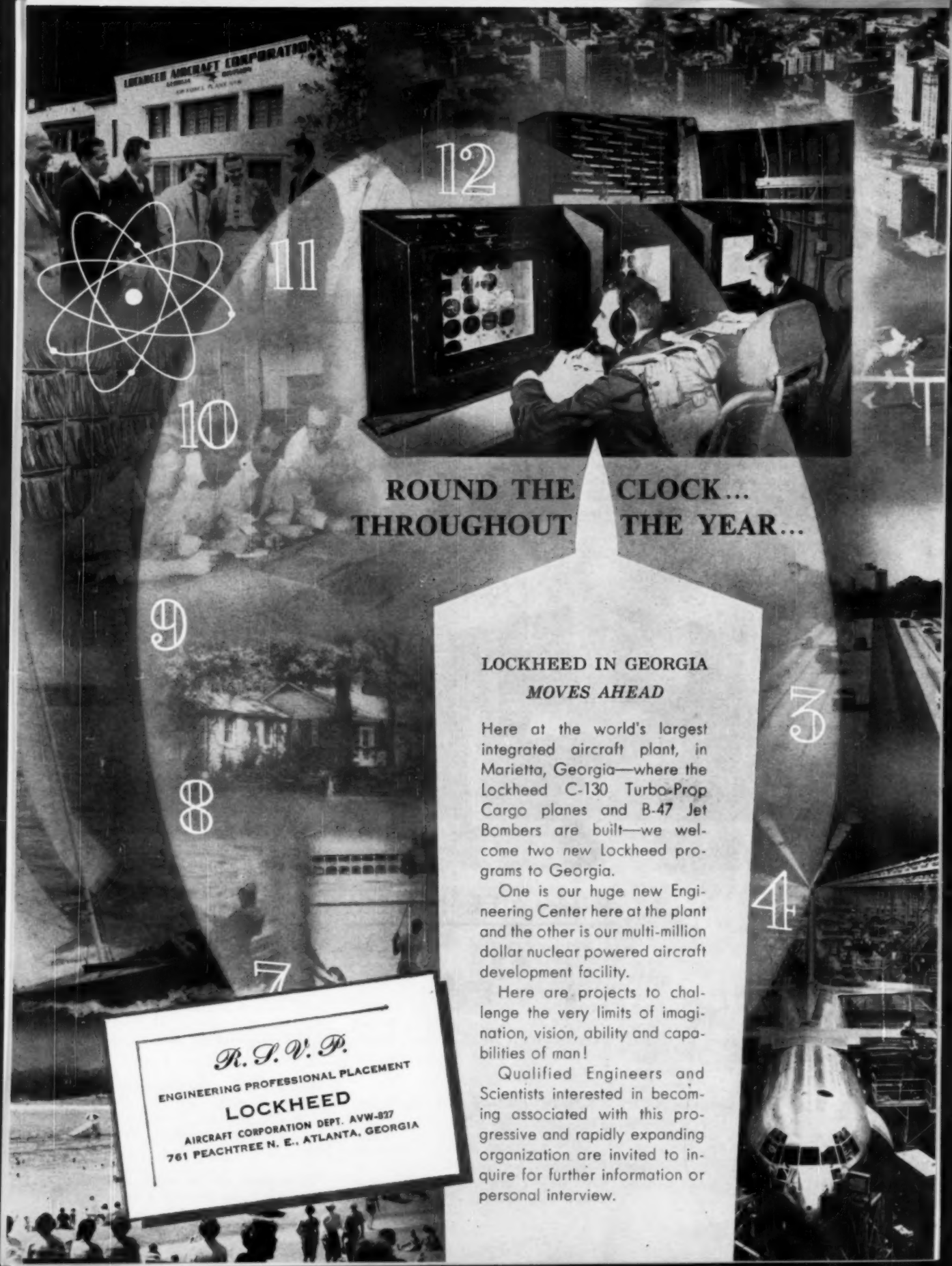
Leading architects in Pittsburgh area were shown a new type roof using glass-fiber construction by means of a helicopter chartered by Owens-Corning Fiberglas Corp. All 20 architects invited by the firm attended the aerial sales demonstration.

Pan-Maryland Airways, Friendship Airport, Md., will supply support maintenance for a dozen Civil Aeronautics Administration planes and a Department of Justice transport plane.

Twenty-eight members of Aviation Distributors & Manufacturers Assn. report June sales totaling $3,795,652, a 22.19% gain over the same month last year.

Royal Gull distributorship was granted Vernell Aircraft, Daytona Beach, Fla., covering Alabama, Georgia, North Carolina, Florida and the West Indies.

Helicopters will be widely used for oil hunt in Papua and New Guinea next



ROUND THE CLOCK... THROUGHOUT THE YEAR...

LOCKHEED IN GEORGIA *MOVES AHEAD*

Here at the world's largest integrated aircraft plant, in Marietta, Georgia—where the Lockheed C-130 Turbo-Prop Cargo planes and B-47 Jet Bombers are built—we welcome two *new* Lockheed programs to Georgia.

One is our huge new Engineering Center here at the plant and the other is our multi-million dollar nuclear powered aircraft development facility.

Here are projects to challenge the very limits of imagination, vision, ability and capabilities of man!

Qualified Engineers and Scientists interested in becoming associated with this progressive and rapidly expanding organization are invited to inquire for further information or personal interview.

R. S. V. P.

ENGINEERING PROFESSIONAL PLACEMENT

LOCKHEED

AIRCRAFT CORPORATION DEPT. AVW-827
761 PEACHTREE N. E., ATLANTA, GEORGIA

year. Three Sikorsky S-58s are expected to be delivered in early 1957 for exploration and initial drilling operations. Drilling equipment will be specially modified for helicopter transportation.

Huntair, Inc., Lindbergh Field, San Diego, is Cessna sales and service dealer for San Diego County.

Remmert-Werner, Inc., St. Louis, Mo., successfully bid on seven DC-3s surplus to the needs of DHY Turkish State Airlines and is returning them to the U.S. for conversion into business aircraft.

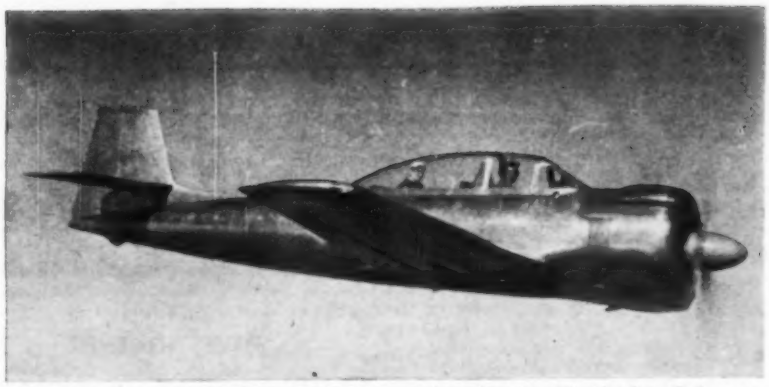
Increase of 63% in commercial helicopter sales in the first half of 1956 compared with the same period last year was recorded by Bell Aircraft Corp.'s Texas Division, Fort Worth. Company delivered 14 civil helicopters in June. Some 75% of civil sales were to established helicopter operators who ordered additional aircraft.

Plane owners now can exchange airworthiness certificates, formerly issued annually, for certificates of indefinite duration if they maintain their aircraft to revised Civil Aeronautics Administration standards. Previously an owner had to get both an annual and periodic examination; now only a periodic examination, made by an authorized mechanic, repair station or the manufacturer is required. Plane owners having unexpired certificates can exchange them for the new certificate at any CAA district office.

A plane factory will be opened in Sao Paulo, Brazil, to build three types of light aircraft. Designer-builder Marc Niess plans to produce the 1-80 two-seater, 2-100 three-seater and 3-150 four-seater. The latter, an all-metal airplane, has its wings swept forward. It may utilize glass-fiber wing spars.

Increase of 40% in total sales volume is reported by Cessna Aircraft Co., Wichita, Kan., for the first nine months of its current fiscal year. Sales totaled $50,970,000, exceeding the total for Fiscal 1955. Primary reason for the boost: An 84% increase in business plane sales over last year.

Beech Bonanza purchased by Ace Drill Bushing Co., Inc., Los Angeles, is expected to log over 1,000 hr. annually servicing 22 company accounts in the U. S. and Canada and aiding sales coordination with about 110 distributors. If scheduled airlines were used, seven weeks would be needed to cover this circuit. Bonanza allows Ace Drill Bushing to handle the same territory twice in four weeks.



HISPANO-Aviacion HA-100E-1 in flight is powered by Spanish Elizalde Beta B-4 engine.

PROTOTYPE HA-100F-1 on ground is powered by Wright 957C-7B A-1 Cyclone.

Spanish Test Messerschmitt Trainer

Seville, Spain—Two trainers, one a turbojet and one piston engine powered, built by Hispano-Aviacion of Seville with the help of Willy Messerschmitt, originated from a common idea, and the basic parts of the aircraft are virtually identical.

The jet trainer is the HA-200-R1 (AW Aug. 13, p. 68). There are two versions of the piston engine type, the HA-100E-1, powered by a Spanish Elizalde Beta B-4 engine of nine cylinders and 750 hp. The other prototype, HA-100F-1, is powered by a Wright 957 C-7B A-1 Cyclone rated at 800 hp. For reasons of economy, the Spanish engine version is preferred for quantity production.

Fuselage is monocoque construction with dural small spars and ribs and alclad skin. Low cantilever wing, also metal (tail surfaces are too) is monospar in a double T section. Two halves are secured to the fuselage at four points.

Full instrument panel, VHF, radio-compass, oxygen equipment and three plate airbrakes are provided. Two 12.7 mm. guns are in wings, and release is provided for four bombs. Four Oerlikon rocket launchers are planned.

Specifications on the two types:

- **HA-100E-1 (Spanish engine).** Length, 25 ft.; span, 32 ft., height, 10 ft., empty weight, 3,234 lb., speed, 277 mph., rate of climb, 2,000 fpm.
- **HA-100F-1 (Wright engine).** Length, 26 ft.; span same; height, 8.9 ft.; empty weight, firing, 3,256 lb.; maximum speed 275 mph., rate of climb 1,700 fpm.

Range of the Wright version is about 45 mi. farther and endurance 20 min. longer.

Messerschmitt's agreement with Hispano-Aviacion allows him to permit the types born in Seville to be used in Germany. The twin-turbojet trainer has been taken to Germany and displayed for German aviation officials. Designations Me-100 and Me-200 refer to the Spanish HA-100 and HA-200.

CAB Accident Investigation Report

Stall in Approach Turn Blamed for Crash

At approximately 1458,[1] Feb. 17, 1956, Eastern Air Lines Flight 156, a Martin 404, N 445A, crashed during landing at the Owensboro Airport, Owensboro, Ky. There were no reported serious injuries to the three crew members and 20 passengers. The aircraft was damaged beyond economical repair.

Eastern Air Lines Flight 156 Feb. 17 was a scheduled operation between Evansville, Ind., and Chicago, with intermediate stops at Owensboro and Louisville, Ky. It utilized the aircraft and flight crew of Trip 157 from Chicago, which terminated at Evansville. The crew consisted of Captain Charles R. Hard, Pilot Raymond F. Rozman, and Flight Attendant Robert T. Schroeter. The Chicago to Evansville flight arrived at 1422, 43 min. late because of traffic and ground delays. It was reported routine in all other respects.

During the short ground time at Evansville Captain Hard reviewed the weather forecasts for the flight Evansville to Chicago, and received the latest weather observation reports for Owensboro, the first stop. These indicated the flight to Owensboro would be in accordance with Instrument Flight Rules and that an instrument approach to the airport there would be necessary. Accordingly, an IFR flight plan was filed and an instrument clearance was given the crew before departure. Clearance was direct to Owensboro at 2,000 ft.

Position Reported

Flight 156 departed at 1441. Gross takeoff weight was 41,471 lb., which was less than the maximum allowable, 43,306 lb. The load was properly distributed with respect to the center of gravity limits of the aircraft.

The crew reported its position en route to ATC (Air Traffic Control) according to its clearance and thereafter at 1447 called the company radio located on the Owensboro Airport. Routine information exchanged between flight and ground personnel included giving the flight the latest weather and altimeter information. There being no control tower at Owensboro, the company there advised the flight that surface wind favored landing on runway 5.

A few minutes later N 445A was observed to descend below the clouds just north of the airport, flying on a southerly heading toward the field. It was observed to level out and turn right onto a downwind leg for runway 5. In the limited visibility, reported as one mile in rain and fog, the aircraft disappeared from view near the southwest boundary of the airport while still on its downwind leg. Shortly thereafter it came back into view, proceeding toward the landing runway. It suddenly struck the ground, right wing down, rolled to an inverted position, and slid to a stop beside runway 5.

[1] All times herein are central standard and are based on the 24-hour clock. Altitudes are mean sea level.

INVESTIGATION

Airport and company personnel reached the scene less than two minutes after the accident. On arrival they found the passengers had already evacuated the aircraft through emergency window exits No. 4 and 8 located on the left side. The crew, last to leave, were momentarily pinned in the cockpit but escaped using the forward loading door. All concerned reported that under the circumstances the evacuation was very orderly and prompt. The Owensboro Municipal Fire Department, on call for the airport, responded promptly; however, there was no fire.

Weather conditions reported at the time were: precipitation ceiling 600 ft., sky obscured; visibility 1 mi.; moderate thundershowers, fog; wind northeast 3; altimeter setting estimated 29.66. At 1510, a few minutes after the accident, conditions were reported as: precipitation ceiling 1,000 ft., sky obscured; visibility 2 mi.; moderate thundershowers, fog; wind calm; altimeter setting estimated 29.68; thunder overhead, movement unknown; lightning in clouds, cumulo-nimbus.

The testimony of many witnesses, including the flight crew, indicated without controversy that the actual weather conditions were equal to or somewhat better than those reported. Several witnesses said a thunderstorm was located southwest of the airport and it was evidenced by at least two lightning flashes observed from it.

Investigation at the accident scene revealed that the initial ground contact of the aircraft was made by the right dual wheels of the extended landing gear. Wheel tracks began 125 ft. to the right and 330 ft. short of runway 5 (50 deg. magnetic). They were 31 ft. long on a magnetic heading of approximately 30 deg.

Physical characteristics of the wheel tracks in the soft, rain-soaked ground showed the aircraft was not slipping or skidding and only a portion of its weight was on the ground. The depth of the tracks gradually increased and then decreased over the distance. There were no marks to indicate the left main or nose gear touched the terrain.

Contact Marks

For the next 16 ft. there were no contact marks. Then for 20 ft. there followed a series of irregular slash marks in the ground made by the right propeller. This irregularity indicated that the engine nose section and its propeller were torn off while the marks were being made. These components were found 230 ft. beyond the last slash marks.

At a point opposite the last propeller mark, gouges showed the right wing struck with sufficient upward and rearward forces to break it off. The right wing center section was sheared practically flush with the side of the fuselage. Characteristics and the sequence of wheel tracks, the propeller cuts, and gouges made by the right wing showed that the aircraft, while still airborne, was rolling to the right along its longitudinal axis.

The fuselage then made ground contact with its right side and rolled toward an inverted position while sliding forward. When the aircraft became inverted the left wing contacted the ground, thus stopping the rolling action but sliding continued for several hundred feet. The ground path swerved gradually to the right.

As the fuselage moved forward it also turned on the vertical axis about 180 deg. and when it came to rest the nose of the aircraft was facing back along its path. The left and right horizontal stabilizers were torn off and the vertical unit was bent 90 deg. to the left.

Examination determined that all landing gear components were extended and locked. The left inboard and outboard flaps were found extended and held firmly by wing distortion. Measurements of the extensions of the flap actuating piston rods corresponded to the takeoff position. The right outboard flap remained attached to its hinges and to the rod of its actuating cylinder, but was free to move because of several hydraulic lines. The right inboard flap was torn from its hinges. The cockpit control was found positioned to select approach flaps. Because of the ruptured hydraulic lines, all flaps could have moved during the breakup and their positions as found were not conclusive as to their positions at initial impact.

Investigation disclosed no evidence of structural failure or malfunction of the aircraft prior to impact and the flight crew stated none was experienced.

Engines Examined

Following preliminary examination at the scene, the engines were sealed and transported to the company's principal base at Miami, Fla. There, under supervision of a Board investigator, the engines were examined in detail.

Results of this examination revealed no evidence of failures or condition which would cause malfunctioning. Both engines were determined to have been in good condition at the time of the accident and were capable of normal operation.

The propellers were also examined. There was no indication of malfunction of these units. Marks on the shim plates of the right propeller showed the following blade positions at the instant of impact: No. 1 blade, 38½ deg.; No. 2 blade, 40 deg.; and No. 3 blade, 40 deg. The settings of the left pro-

peller blades were: No. 1 blade, 37 deg.; No. 2 blade, 35½ deg.; and No. 3 blade, 43½ deg. The propeller governors indicated engine speeds at impact of 2,270 and 2,325 rpm. for the left and right engines, respectively. Assuming an airspeed between 95 and 110 kts., the average blade position found indicated that appreciable power, nearly maximum, was being produced by both engines at impact.

The Owensboro Airport is located 29 mi. southeast of Evansville at a field elevation of 407 ft. Runway 5 is one of two runways and is 3,700 ft. in length. Terrain surrounding the airport is gently rolling with the runway approaches unobstructed.

Eastern Air Lines is authorized to operate into the airport under both visual and instrument conditions. A commercial broadcast station, WVJS, located 1.9 mi. north of the airport on a bearing of 14 deg., serves as the approved navigational facility for an ADF (Automatic Direction Finder) instrument approach to the airport. Eastern's Martin 404 minimums for this approach, the only type approved, are: ceiling 500 ft., visibility 1 mi.

Approach Procedure

In accordance with a clearance, Evansville to Owensboro, direct, the instrument approach procedure required Flight 156 to pass over the commercial broadcast facility and establish an outbound track of 14 deg. The instrument approach then requires a procedure turn to an inbound track of 194 deg.

This, if maintained, again takes the flight over the commercial station to the airport. Descent in two intervals is required during the procedure to the minimum altitude, whereupon visual reference should be established with the ground normally just north of the airport. The aircraft is then positioned to land straight-in or circle to the runway of intended landing.

During the investigation and public hearing Captain Hard and Pilot Rozman related in detail the events concerning the accident. They stated the flight to Evansville was routine, as were preparations for the Owensboro segment of Flight 156. Pilot Rozman flew the aircraft to Owensboro, noting that there was a strong westerly wind at the cruising altitude of 2,000 ft.

Pilots and passengers said the trip was very smooth with the ground dimly visible through restricted vertical visibility and clouds. Above, there was an overcast from which moderate rain fell intermittently. Thunderstorm turbulence forecast to exist was not encountered.

When approximately 20 mi. from Owensboro the company radio was contacted and the flight received the latest weather conditions reported on the airport. Procedural information was exchanged and according to established procedures the company notified the commercial station of the flight's approach and the station broadcast its identification. This was received by the flight.

According to the crew, the instrument procedure was followed precisely and completely. During it, the aircraft was slowed to approach speed, takeoff flaps were extended, and the landing gear was lowered. The propellers were adjusted to 2,300 rpm. and other prelanding checks were completed. Visual contact was established approximately one mile north of the airport at about 550 ft. above the ground.

Captain Hard and Pilot Rozman had agreed that upon sighting the airport the position of the aircraft relative to the runway would govern which one of them made the approach and landing. The position favored a left-hand pattern; therefore, Captain Hard took control when the airport was sighted. He stated that when slightly northeast of the field he turned right to position the aircraft on its downwind leg. According to the crew the aircraft was then at an airspeed of approximately 120 kts, 400–450 ft. above the ground. Captain Hard said that when approximately opposite the threshold of runway 5 he began a left turn, using a normal 30-deg. bank, and asked Rozman to apply approach flaps. Pilot Rozman stated he complied, setting the control to that position. The captain checked the flap position.

Wing Drops

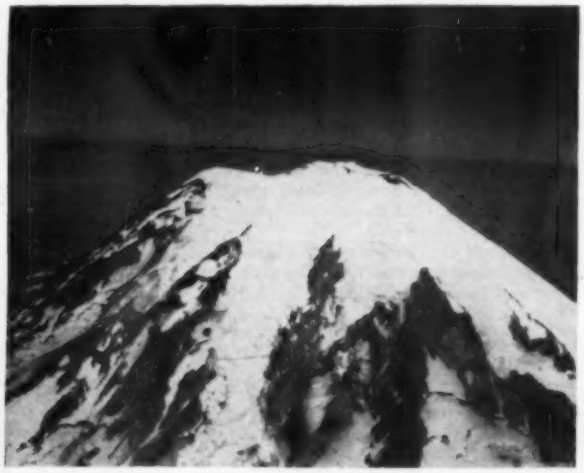
The crew members stated that when 45–60 deg. from the runway heading there was a slight vibration through the aircraft. This was followed by a gradual lowering of the left wing which steepened the bank. Both agreed and stated that the wing went down gradually and not from any control movement.

Captain Hard added power to 38–39 in. of manifold pressure and called, "Roz give me a hand." Together they applied control to raise the wing and stated it responded normally. Airspeed was 110 kts.

The crew members stated that the aircraft was then on final approach, descending with its wings level. The runway was approximately one-fourth mile ahead but the aircraft heading had exceeded (overshot) runway alignment to the left 5 or 10 deg.

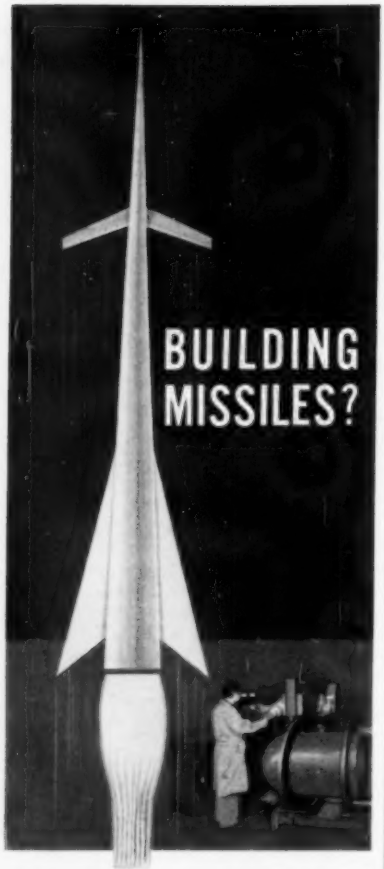
Both crew members said there were a few seconds during which the aircraft descended with wings level in a normal approach attitude. Then, the pilots said, the right wing dropped without warning but accompanied by a shudder and buffet, minor in degree. Captain Hard immediately applied corrective control to lift the wing and also raise the nose. Believing the worst that could happen would be a hard landing off the runway, the captain said he did not attempt to abandon the approach. While still attempting to correct the wing-low position and raise the nose of the aircraft, ground contact occurred.

In response to direct questions, the captain and pilot stated that moderate rain was



Helicopter Mountain Survey

A Bell helicopter carried out an unusual high-altitude assignment: taking a survey team and equipment to the top of Mt. Rainier, more than 14,000 ft. above sea level. Helicopter was a standard Model 47G-2, stripped down to an operating weight of 1,870 lb. by removing landing light, dual controls, doors, radio and the battery. William Quinlan, Bell experimental test pilot, flew the craft on seven round trips, landing near the center of the mountain top on an ice-coated area. The mountain was reconnoitered on the first day to establish and mark a landing site. Two days later, Quinlan made three trips to the peak to take equipment and two engineers up and three more to bring them back. Survey was part of United States Geological Survey.



RESEARCH WELDING

for fabrication beyond the standard concept

For fabrication of guided missile components and atomic structures and for other technical projects, Research Welding is equipped to process experimental work requiring high-strength or corrosion-resistant alloys.

Our facilities include a 650-ton capacity HPM metal forming hydro press and the latest automated welding equipment. Mass Spectrometer and hydro testing; USAF-approved quality control procedures.

Research Welding has developed components for CalTech, Douglas, DuPont, Firestone, GE, Hughes, Bell, Northrop, USAF.

Let us analyze your problem. Call or write today for information. New, ultra-modern plant now under construction will provide even greater facilities for the scientific development of your special projects.

RESEARCH
WELDING & ENGINEERING CO., INC.

10608 SANTA FE AVE. • SOUTH GATE, CALIFORNIA

falling during the approach and that visibility and ceiling conditions were better than reported, with the runway visible throughout the entire circling approach. No turbulence was encountered. Captain Hard added that he did not believe the aircraft was stalled and stated that there were definite intervals between the left wing going down, the recovery, the straight-in approach, and the final dropping of the right wing.

Several passengers were called to give testimony at the public hearing, and several others gave formal statements. These were principally in agreement with the testimony of the crew until the aircraft was near Owensboro. None recalled the turning maneuvers associated with the instrument approach procedure, as described by the crew, but several recalled when the flight became contact and the right turn onto the downwind leg.

In this area, several passengers, including a commercial and instructor-rated pilot, stated the flight was considerably lower, in their opinion, than 400–450 ft. Several of them recalled the left turn, the slight shudder, and the gradually increased bank described by the crew. They placed the events considerably closer to the accident and at a lower altitude than did the crew.

All who testified said the aircraft turned left for some period at a normal degree of bank, then there was gradual steepening of the bank. Two passengers said that during the left turn they thought the left wing would hit the ground and another thought that it did.

Their testimony indicates that the aircraft, without any time interval or recovery, rolled from a steep left bank to the right in a continuous motion and hit the ground. Nearly all stated that during this sequence an application of power, comparable to that used at takeoff, was heard.

The pilot-passenger felt a gradual but positive application of back pressure during the same sequence. He described the events, from his instructor's experience, as an "over-the-top stall." Two passengers stated that the flight attendant exclaimed, "We've had it!" and braced himself just before the initial ground contact. The attendant stated he did not recall his exclamation but remembered he had braced himself by placing his feet against the back of the seat ahead.

A few ground witnesses saw the aircraft pass over the northeast boundary of the airport, turing right to establish the downwind leg. All agreed that at that time the engines sounded normal and that the position and altitude were comparable to other flights under similar conditions.

There were no ground witnesses who saw the aircraft from the time it disappeared on the downwind leg until a few seconds before it crashed. At this time three witnesses saw it proceeding toward the runway. Two stated the left wing was down and the aircraft was low. These witnesses said the aircraft rolled to its right, from left bank to right, without stopping until the right wing hit the ground causing a spray of mud and water.

One witness believed there was an interval when the aircraft was level between the left-to-right rolling action.

Witnesses on the ground, including weather observers, said the wind was nearly calm for a considerable period before and after the accident. Testimony indicated moderate rain was falling during the accident period and that it did not vary in intensity.

Several persons also saw at least one lightning flash from a thunderstorm a short distance southwest of the airport. It appeared to the witness that the flash occurred close to the aircraft when the accident occurred. Neither the crew nor the passengers reported any lightning flashes, nor did any part of the airplane indicate a lightning strike.

During the investigation of this accident the records of Captain Hard were carefully reviewed. He, at the time of the accident, had been a pilot for the company more than 16 years and a captain since 1948. His records indicated he was trained for his position in accordance with the company program and had received the regular and frequent captain proficiency checks required. These were passed satisfactorily. Captain Hard was qualified over the route involved and had landed at Owensboro an estimated 100 times. Captain Hard qualified on the Martin 404 in 1952, had flown it more than 3,000 hr., and had flown it exclusively for several years.

Weather conditions that existed in the Owensboro area at the time of the accident were dominated by a low pressure area centered in east Texas from which a trough extended northeastward through the subject area, then northward to the Great Lakes.

Also factors in the conditions were two quasi-stationary fronts emanating from the low and extending northeastward through the area. The northernmost front passed

STEEL

Every Kind

Quick Delivery

Aircraft Quality Alloys and Stainless Steels also bars, structurals, plates, sheets, tubing.

RYERSON

Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Wallingford, Conn., Philadelphia, Charlotte, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Milwaukee, Chicago, St. Louis, Seattle, Spokane, Los Angeles, San Francisco

through southeastern Oklahoma, northern Arkansas, central Indiana, and into northern Ohio. The other was parallel to it but well south of the Evansville-Owensboro sector. These factors produced showers and thunderstorms in the frontal zone with overcast conditions over the entire route.

Moderate to severe turbulence was forecast in the thunderstorms, with ceilings and visibilities near minimums at Owensboro. The icing level was expected to exist between 8,000 and 10,000 ft.

ANALYSIS

Analysis of the available surface, upper air, and synoptic weather information indicates that at the time of the accident moist, unstable, warm air was overrunning a stable cooler layer in the Evansville-Owensboro area. It appears the cooler layer extended from the surface to between 3,000 and 4,000 ft. Flight 156 cruised at 2,000 ft. remaining in this stable air which accounts for the smooth flight to Owensboro. Although thunderstorms existed, they were above the stable air.

There was no evidence of an overriding wind below 500 ft. Surface winds were consistently reported calm or very light for substantial periods before and after the accident. Also it appears there was little change in these conditions between reports.

Lightning was observed southwest of the field in the direction of the approach area to runway 5. Winds were from the southwest at altitudes controlling the movement of the thunderstorms; therefore, the thunderstorm southwest of the field should have shortly thereafter passed over the field. Official weather observations indicated that the lightning was in the clouds instead of cloud-to-ground. This indicates a thunderstorm cell in a dissipating stage rather than one with vigorous downdraft.

If a downdraft and strong outflow existed at low altitudes, it would likely cause the surface wind to be at least fitful or gusty and the barograph tracing to have sharp changes, both of which were negative. It is, therefore, considered very doubtful that any strong or shifting winds affected the flight during the approach. Weather reports and observations by all concerned indicated the ceiling and visibility conditions at Owensboro were above the minimums for landing.

Available evidence indicates that Flight 156 was properly planned and flown in a normal manner to the vicinity of the Owensboro Airport. It indicates that visual reference to the ground was established about one mile north of the airport and that this position was normal after completion of an instrument approach.

At this time the aircraft was in a better position for its crew to make a left-hand pattern for landing on runway 5. The cockpit position of Captain Hard, being on the left or inside of the pattern, made it reasonable for him to execute the approach; therefore, he took control and flew the aircraft thereafter.

The evidence, except for statements of the crew, indicates that the position on the downwind leg from which the left turn was started to align the aircraft with runway 5 did not allow sufficient distance for a normal turn to the runway and resulted in an abnormally steep bank.

Further, it is apparent from nearly all passenger observations that the turning was continued to a low altitude. The Board is of the opinion that these factors indicate poor planning and execution of the approach by Captain Hard.

Undoubtedly his actions were influenced by the limited visibility; however, as the turn progressed the miscalculation should have become apparent to him with sufficient opportunity to have discontinued the approach.

Although both crew members stated the left wing of the aircraft went down when 45–60 deg. from the runway heading, it is our opinion that this occurred much later during the approach and just before the accident. It is believed that the aircraft was turning left almost continuously until it began to roll from left to right. It appears that the rolling action resulted from a stalled condition of the aircraft caused by insufficient airspeed and increased back pressure as Captain Hard attempted to raise the nose and left wing to avoid striking the ground.

This is supported by many passengers who said the left wing nearly hit the ground and one who believed that it did. Two ground witnesses, who saw the aircraft only a few seconds before the crash, also said the left wing was down and that the aircraft was nearly aligned with the runway when the roll began. Nearly all witnesses said that roll was continuous from left to right.

Evidence indicates that the situation became critical during the latter portion of the approach and that Captain Hard was aware of it. That corrective action was attempted by power application is substantiated by passenger testimony and by physical evidence which showed that the engines were developing nearly full power at impact. Although the power application was too late to prevent the accident it undoubtedly decreased the force with which the aircraft struck the ground.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The company, the aircraft, and flight crew were currently certificated.

2. The flight was properly dispatched and cleared according to Instrument Flight Rules to Owensboro, a scheduled stop.

3. At departure the aircraft was loaded to a weight less than the maximum allowable and the load was properly distributed.

4. En route weather conditions were correctly forecast except thunderstorm turbulence expected was not encountered.

5. Weather conditions reported were above the minimums for the flight to execute an ADF approach, circle, and land.

6. Weather conditions experienced by the flight were equal to or better than those reported.

7. The flight established visual contact with the ground at a position which was normal following the completion of the specified instrument approach procedure.

8. A circling approach was begun to land on runway 5.

9. The position on the downwind leg from which a left turn was begun to align with runway 5 resulted in little or no straight-in portion of the approach and an abnormally steep turn.

10. During the latter phase of the approach while at low altitude the aircraft rolled from a steep left bank to the right in a continuous motion.

11. The aircraft struck the ground short of and to the right of the runway of intended landing in an uncontrolled attitude.

12. There was no evidence of malfunction or failure of the aircraft, its engines, or propellers.

13. Thunderstorm turbulence, wind shift, and lightning were not factors in the accident.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was an improperly executed final approach, resulting in a stall, during a steep left turn at an altitude too low to permit recovery.

By the Civil Aeronautics Board:

/s/ James R. Durfee
/s/ Joseph P. Adams
/s/ Chan Gurney
/s/ Harmar D. Denny
/s/ G. Joseph Minetti

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of this accident at 1650, Feb. 17, 1956. An investigation was immediately commenced in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. A public hearing ordered by the Board was held at Owensboro, Ky., on Mar. 22 and 23, 1956.

Eastern Air Lines, Inc., a Delaware corporation with principal offices in New York City, is engaged in the transportation by air of persons, property, and mail under current certificates of public convenience and necessity issued by the Civil Aeronautics Board. The carrier possesses an air carrier operating certificate issued by the Civil Aeronautics Administration for various routes, including the one over which the accident occurred.

Captain Charles R. Hard, age 41, was employed by Eastern Air Lines on Dec. 9, 1938, and became a pilot for that company in 1942. He was promoted to captain on Mar. 1, 1948, and had accumulated 10,491 flying hours at the time of the accident. Of these hours, 3,182 were in the Martin 404 and 1,442 were instrument. Captain Hard held an airline transport rating and a rating on the equipment involved. His last instrument check was successfully completed Nov. 12, 1955, and his most recent CAA physical was passed, without waivers, Aug. 21, 1955.

Pilot Raymond F. Rozman, age 31, was employed by the company on Feb. 11, 1952. He had 4,292 flying hours, of which 2,616 were in the type equipment involved. He held a currently valid airman certificate with commercial and instrument ratings. Pilot Rozman received his last CAA physical examination Oct. 8, 1955.

Flight Attendant Robert T. Schroeter, age 28, was employed Sept. 12, 1950, by Eastern Air Lines and was promoted to flight attendant Oct. 9, 1950. His training for emergency procedures was complete and current at the time of the accident.

N 445A, a Martin 404, manufacturer's serial number 14122, was owned and operated by Eastern Air Lines and had accumulated 12,373 hours since its manufacture Dec. 16, 1951. It was powered by Pratt and Whitney R-2800-CB3 engines equipped with Hamilton Standard 43E60-349 propellers.

Some people never answer ads ...

BUT THEY SHOULD! Take you, for instance. You like your job—you like the boss—chances are you even like your neighbors. It hasn't occurred to you to answer a recruitment ad for a long, long time—and that makes you just the man who ought to answer this one.

You're the man we'd like to tell about working at the Southern California Cooperative Wind Tunnel, and about living in Pasadena. We think you'll find a good many advantages to both—a good many things you'd like to consider.

No resumes to send—nothing you need do but mail the coupon below for the CWT story. The longer it's been since you answered an ad, the more we think you're the man who should answer this one.

CWT

Operated by the California Institute of Technology. Owned by Convair, Douglas, Lockheed, McDonnell and North American.

CWT is concerned with testing, analysing and solving aerodynamic problems involved in the development of high-speed aircraft and guided missiles.

Southern California Cooperative Wind Tunnel

Pasadena, California

GENTLEMEN: *Please send me literature about the Wind Tunnel.*

NAME_____

HOME ADDRESS_____

CITY_____ STATE_____

WHO'S WHERE

(Continued from page 23)

Robert M. Peterson, assistant chief engineer (electronics), Stromberg-Carlson, a division of General Dynamics Corp., San Diego, Calif. Also: **Howard W. Grossbohlin,** tube and component engineering head.

T. Lawrence Cronin, Jr., director-industrial relations, Greer Hydraulics, Inc., Jamaica, N. Y.

William L. Aldrich, assistant director-industrial relations, Northrop Aircraft, Inc., Hawthorne, Calif. Also: **Edward J. Baum,** manager-industrial and public relations, Anaheim Division.

John L. Moore, head-editorial and graphic services, Aerophysics Development Corp., Santa Barbara, Calif.

Norman E. Eggers, assistant manager-commercial aircraft sales, Aircraft Engines Operations, Allison Division of General Motors Corp., Indianapolis, Ind.

Robert K. Johnson, sales manager, Borg Equipment Division, George W. Borg Corp., Janesville, Wis.

R. B. Springer, sales manager, Tactair Division, Aircraft Products Co., Bridgeport, Pa.

Harold H. Gillespie, assistant general manager, Barden Corp., Danbury, Conn.

Walter Poremba, assistant sales manager, Alloy Precision Castings Co., Cleveland, Ohio.

Donald F. Austin, West Coast sales engineer (Los Angeles), Kay Electric Co., Pine Brook, N. J.

Seth H. Stoner, chief engineer, and **Frederick J. Garbarino,** divisional director of quality control, New Departure Division, General Motors Corp., Bristol, Conn.

H. F. A. Sessions, industrial relations director, Midvale-Heppenstall Co., subsidiary of Heppenstall Co., Pittsburgh, Pa.

Alfred Sansonetti, manufacturing manager, Avien, Inc., Woodside, N. Y.

E. C. Johns, assistant manager-aircraft products sales, Leland Electric Co., division of American Machine & Foundry Co., Dayton, Ohio.

Merwyn A. Kraft has joined Flight Safety Foundation, Inc., New York, N. Y. He is coordinator of a research project for the CAA.

Dr. James E. Ash, supervisor-fluid mechanics and fluid power section, Armour Research Foundation, Illinois Institute of Technology, Chicago, Ill.

Walter L. Hahn, sales manager, Twigg Industries, Inc., Brazil, Ind.

K. C. Jones, public relations director, United Air Lines.

Darrell G. Smittle, staff engineering supervisor, Commercial Seating Division, Weber Aircraft Corp., Burbank, Calif.

Robert W. Erdmann, manager-traffic administration, and **David E. Moran,** staff assistant to the vice president-traffic and sales, North Central Airlines.

Herbert L. Weiss, supervisor-field service and installation, Federal Telephone and Radio Co., Clifton, N. J.

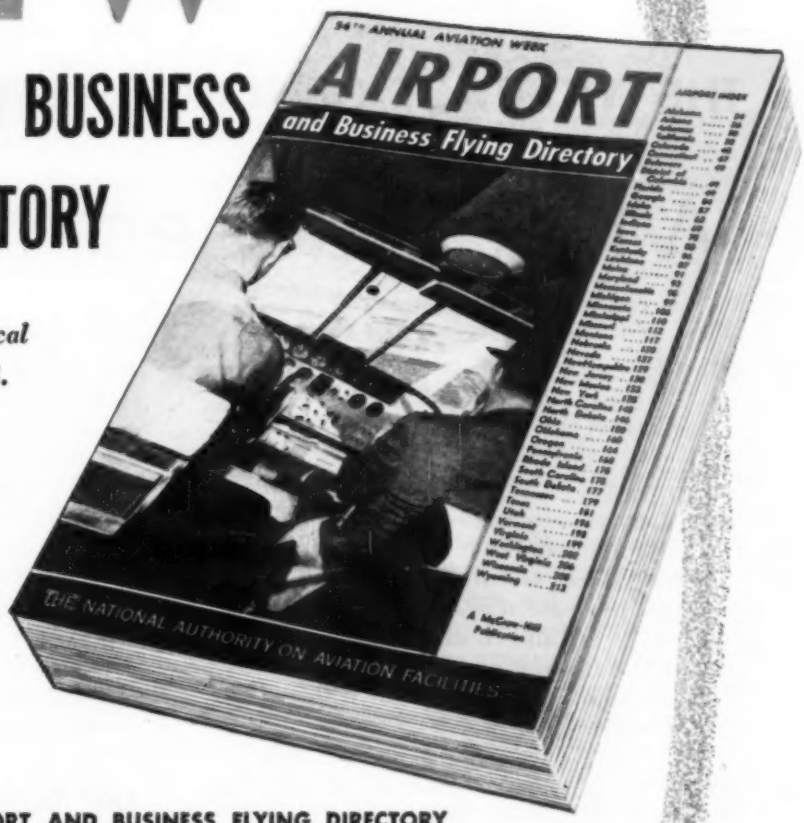
Albert Hapke, assistant director-European service (Paris, France), Republic Aviation Corp., Farmingdale, N. Y.

NEW

AIRPORT AND BUSINESS FLYING DIRECTORY

Get your FREE Aeronautical Planning Chart of the U.S.

AVIATION WEEK offers this valuable U.S. Coast and Geodetic cross country flying aid free with your copy of the NEW AIRPORT AND BUSINESS FLYING DIRECTORY



ANNOUNCING

THE ALL NEW 1956-1957 AIRPORT AND BUSINESS FLYING DIRECTORY

Just off the press . . . an accurate and detailed 276 page handbook of thousands of business flying's vital facts and figures.

This business flying handbook has been designed to meet the need expressed in your letters and personal interviews for a ready reference of the latest full-scale information about business flying and airport facilities . . . **only $4.00.** (We will bill your company if desired). LAST YEAR MANY ORDERS WERE UNFILLED DUE TO EARLY "SELL OUT." BE SURE YOU GET YOURS. . . . FILL OUT COUPON AND MAIL IT NOW.

FEATURES:

EDITOR'S REPORT: Including the latest technical and business developments along with a forecast of future trends.

EQUIPMENT: Pictures, detailed descriptions and specifications of new aircraft and engines.

AIRCRAFT CONVERSION: Includes a 2-page specifications table, especially compiled by the editors, lists the major conversion centers, technical data on the business-liners they produce, the number flying and current prices.

AIRPORTS AND FACILITIES: 6,000 up-to-date airport listings and thousands of airport and flight facts are provided including locations, number and type of runways, lighting and field markings, approach obstructions, radio and weather facilities, repair and hangar facilities, out-of-state fuel taxes, restaurant and overnight service, etc.

CAA, TRAFFIC, WEATHER, COMMUNICATIONS INFORMATION: Maps of CAA regions and offices, air defense identifications zones, U.S. Weather Bureau information and office phone numbers.

MAIL COUPON NOW!

AIRPORT AND BUSINESS FLYING DIRECTORY
330 West 42nd Street, New York 36, N. Y.

Please send my copy of the AIRPORT AND BUSINESS FLYING DIRECTORY and free aeronautical chart of U. S. to the following address:

Name:_____

Address:_____

City:_____

Company:_____

Aviation Interest:_____

Bill Company ☐ Check enclosed ☐ $4.00 enclosed ☐

AW1

THE SHORTAGE OF SCIENTISTS AND ENGINEERS:

What Caused It?

WHY is the United States confronted with a serious shortage of scientists and engineers?

One reason, discussed in earlier editorials in this series, is that the increasingly complex technology needed for national security and for an expanding economy has raised enormously the demand for technically trained people.

But it is clear also that too little has been done to increase the supply of scientists and engineers and to make most effective use of the limited number now available. It is with this second reason for the shortage that this editorial deals.

Too few bright young people have been attracted to careers in the sciences and engineering. Many with technical training have been leaving these professions, with the exodus from teaching being especially alarming. And the technical talent now employed in industry, government and education is, in too many instances, being utilized less effectively than it might be.

Paying for a Miscalculation

A legacy of the depression provides part of the explanation for the current shortage of young people entering scientific and engineering careers. Because of low birthrates in the 1930s, there are now about one million fewer boys and girls of college age than there were in the early 1940s. Not until 1960 will there be as many in the 18-21 age group as in 1945. And from the brightest young people of these ages must come, not only scientists and engineers, but the new members of all the professions needed by our growing economy.

A miscalculation in the late 1940s, when our future needs in various occupations were being gauged, provides another part of the explanation. Occupational counselors and high school students were advised that, because of heavy postwar enrollments in engineering and other technical fields, "it is likely that the shortages of trained men will be alleviated in a few years."*

Instead of being alleviated, however, the shortages became more acute. Job opportunities grew rapidly, while graduating classes dwindled. Fewer than half as many students received degrees in engineering in 1955 as in 1950, the peak postwar year. The trend has been reversed, but graduating classes will not be large enough to narrow the gap for several years.

Lost Talent

Beyond these temporary conditions, there is another explanation for the failure of the number of scientists and engineers to keep pace with our rising needs. This is the staggering loss between high school and college of young people with the talent to be successful in science and engineering. **Last year between 60,000 and 100,000 high school graduates of college ability failed to enroll in college for financial reasons and perhaps an additional 100,000 did not enter college because of lack of interest.†**

Of the most intelligent 20 percent in the group of college age, fewer than half enter college and only about a third graduate from college. Educational authorities estimate that fewer than 2 percent of those in the college age group who are mentally equipped to obtain Ph. D. degrees will actually obtain such degrees.

Another crucial stage is in the high

*U. S. Bureau of Labor Statistics, *Occupational Outlook Handbook* (Bulletin 940), p. 63.

†Charles C. Cole, Jr. (assistant dean, Columbia College, Columbia University), *Higher Education*, November 1955.

schools, where future scientists and engineers receive their first training in science and mathematics. There are serious weaknesses and signs of deterioration in this vital part of our educational system.

One-quarter of all American high schools offer no chemistry or physics. One-quarter offer no geometry. In many of the schools offering science and mathematics courses, the quality of instruction is low. Last year in the New York City school system alone more than 10,000 students were in science classes taught by teachers who were not trained in science.

This is a situation that threatens to become much worse. Between 1950 and 1955 the number of graduating teachers qualified to teach high school mathematics dropped 53 percent and those qualified to teach science dropped 59 percent. Furthermore, only about 60 percent of the graduates certified to teach mathematics or science in 1955 entered teaching as a career.

On the students' side — partly because of inadequate guidance programs — there has been a drift away from science and mathematics courses. The result of low student interest, and poor high school programs, in science and mathematics is virtually to foreclose careers in science and engineering to many bright young people. They miss the necessary basic training. Many who do attempt to obtain college training in these fields are ill-equipped. Engineering school deans report that fully half of their students enter with deficiencies in mathematics.

Misuse of Trained People

Scientific and engineering careers have long had a reputation for low salaries and limited opportunities for advancement. In recent years starting salaries have sky-rocketed and have been accorded wide publicity. But unfortunately there has been much less improvement in the salaries paid experienced engineers and scientists, especially in government and education. This has lowered the morale of experienced men and provided an incentive to desert engineering and research positions for higher paying jobs in sales or management.

Engineers and research scientists complain also that too much of their time now is spent on tasks that draftsmen and technicians could perform. Unfortunately for easy solution of this problem, however, there is an acute shortage of technicians as well. Worse still, there are indications that some companies in industries using large numbers of engineers have gobbled up technical manpower at a faster rate than they can effectively employ these scarce people.

Another drain on the supply of newly-trained scientists and engineers is military service. About 8,000 of this year's 27,000 engineering graduates were in ROTC programs and committed to active duty after graduation. Dr. A. W. Davison, chairman of the Engineering Manpower Commission of the Engineers Joint Council, says that in most cases no attempt is made by the Armed Services to assign these young officers to duties for which their engineering education specifically prepared them. They are not only withheld from industry and education for two years but also are not utilized in defense programs requiring more engineers and research scientists.

Some of the causes for the present shortage of scientists and engineers — bad advice a few years ago and a college age group held down by depression birthrates in the 1930s — are gradually being overcome. But others, such as the deterioration of science and mathematics training in our public schools and the many instances of ineffective utilization of scarce technical talent, enjoy no such prospect of automatic correction. The final editorial in this series will deal with some practical suggestions for meeting these problems.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

BUMBLEBEES CAN'T FLY!

You've heard the old story!

Rohr engineers, too, are busy every day solving near-impossible problems related to many phases of flight—important, challenging design and production problems on hundreds of vital, major aircraft components.

One example: The development and production of complex stainless-steel, honeycomb sections for high-speed aircraft and missiles.

Rohr is humming these days with more and more large military and commercial contracts.

Skilled engineers are urgently needed to grow with these big, long-range programs. Young men are offered outstanding career positions with unmatched opportunities for advancement within this large, fast-growing aircraft firm.

Especially needed now at Rohr are: *Design, Stress and Structures, Lofting, Equipment, Electrical, Liaison, and Aircraft Industrial Engineers, Thermodynamicists, Metallurgists.*

Write us today! Learn about our sound management policies, personal benefits, chances for quick advancement and other career advantages here at Rohr in beautiful Chula Vista located on cool San Diego Bay.

Please write giving complete details and we will answer at once.
J. L. Hobel, Industrial Relations Manager, Rohr Aircraft Corporation, Chula Vista, California, Dept. 29

WORLD'S LARGEST PRODUCER OF

READY-TO-INSTALL POW-R-PAX FOR AIRPLANES

ROHR
AIRCRAFT CORPORATION

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

NATIONAL COVERAGE

Positions Vacant
Positions Wanted
Part Time Work

Civil Service Opportunities
Selling Opportunities Wanted
Selling Opportunities Offered

Employment Agencies
Employment Services
Labor Bureaus

DISPLAYED —RATES— **UNDISPLAYED**

The advertising rate is $27.60 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$2.10 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.
Box Numbers—counts as 1 line.
Position Wanted ads are ½ of above rate.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.
Not subject to Agency Commission.

Send NEW ADS to Classified Advertising Div. of AVIATION WEEK, P.O. Box 12, N. Y. 36, N. Y.

REPLIES (Box No.): Address to office nearest you c/o This publication Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

POSITIONS VACANT

Analysts—Traffic & Economics. Executive offices in eastern city. Age 25-35 preferred. P-1155, Aviation Week.

Helicopter Pilot wanted for Florida operation. Commercial Bell experience preferable. Include educational and flight background in first letter. P-2510, Aviation Week.

Accountant—General Ledger. Heavy experience in all cargo airline accounting. Must be familiar with C.A.B. uniform systems of accounts and related statistical reporting requirements, location, Miami, Florida. Salary open, good working conditions. Apply Director of Personnel, Riddle Airlines, P. O. Box 535, Miami, Florida.

Aeronautical Engineering Group Superintendent—The Bureau of Aeronautics, Navy Department, has an opening for an Aeronautical Engineering Group Superintendent, at the Naval Air Station, Alameda, California. The salary for this key position is at the GS-14 level, $10,320 per annum. This superintendent is the top civilian reporting to the Naval Officer in charge of the Aeronautical Engineering Group. A minimum of ten years education and experience is required: a bachelor's degree in aeronautical or a related branch of engineering, plus at least six years of professional engineering experience, including three years of supervisory experience. Standard Form 57, Application for Federal Employment, which may be obtained at any first—or second-class post office, should be sent to the Bureau of Aeronautics, Personnel Division (PE-252), Main Navy Building, Washington 25, D. C.

POSITIONS WANTED

USAF Pilot leaving service. 3000 hours military. 1000 hrs. civilian. Commercial SMEL. Instrument. Instructor, A&E. ATR written passed. Former Navigator. College Graduate. 1000 hrs. C-47 instructor. Don't drink or smoke. Married. Age 31. Presently own Bonanza. Desire permanent pilot or co-pilot position. Capt. Doty, Box 4115, Hq. AMC, Wright-Patterson AFB, Ohio.

Competent Pilot. age 30 (3000 hrs) European and American background, interested in import and export sales, or any aviation position with a future. Speaks fluent Dutch, German, Flemish, French. PW-2778, Aviation Week.

AVAILABLE—EXPERIENCED MANUFACTURING REPRESENTATIVE FOR WEST COAST
Can offer sales engineering and good acquaintanceship in the industry over an extended period. Inquiries invited. Commission or?
RA-2757, Aviation Week
1125 W. 6 St., Los Angeles 17, Calif.

EMPLOYMENT ADS
IN AVIATION WEEK
BRING RESULTS!

SYSTEMS ENGINEERS AIRCRAFT

Automatic Flight Controls

Staff position available for highly qualified engineer with autopilot design and development experience. Duties will include the preparation of design specifications, coordination of technical and project group efforts relating to autopilots, as well as maintaining close liaison with autopilot subcontractors. Heavy servo experience mandatory, with flight test experience helpful but not necessary.

Fire Controls

Staff position for highly qualified engineer with fighter aircraft fire control system experience. Design background in radar, toss bomb computers, gun sights, etc., indispensable for providing design direction and liaison with fire control subcontractors. Flight test experience desirable but not essential.

Please send complete resume including details of your technical background to:

Mr. David G. Reid
Engineering Personnel Mgr

REPUBLIC AVIATION
FARMINGDALE, LONG ISLAND, NEW YORK

PERFORMANCE and INSTALLATION ENGINEER

There are two positions open in the preliminary design activity of General Electric's Small Aircraft Engine Department, located in West Lynn, Mass. This activity deals with performance requirements and installation analysis of proposed engines. It guides Design and Development Engineers in planning characteristics and configuration of new engines and integrating them with advanced type aircraft.

Requirements are a Bachelor or advanced degree in mechanical or aeronautical engineering, plus 3 to 5 years' engineering experience in airframe or aerodynamics, and a working knowledge of air inlet, exhaust nozzles, ducting, and cooling problems.

The salary is commensurate with ability and experience, and is coupled with many other company benefits. These positions offer an opportunity to be a forerunner in power plant development and to grow professionally in our well-recognized engineering organization.

For further information prior to personal interview, write to:

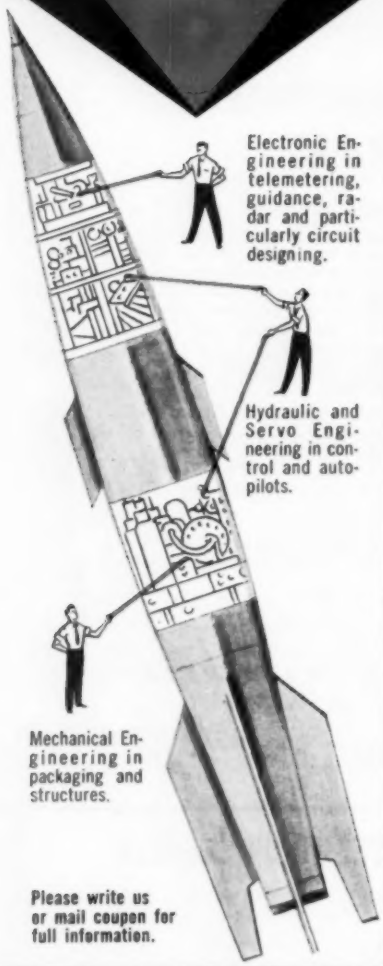
Mr. T. S. Woerz (Section 4-B)

SMALL AIRCRAFT ENGINE DEPT.

GENERAL ELECTRIC

1000 Western Avenue, West Lynn, Mass.

THIS IS THE KIND OF ENGINEERING HELP WE NEED!



Electronic Engineering in telemetering, guidance, radar and particularly circuit designing.

Hydraulic and Servo Engineering in control and autopilots.

Mechanical Engineering in packaging and structures.

Please write us or mail coupon for full information.

W. C. Walker, Engineering Employment Mgr.
Pacific Division, Bendix Aviation Corp.
11600 Sherman Way, North Hollywood, Calif.

I am interested in this engineering field____
I am a graduate engineer with ____degree.
I am not a graduate engineer but have ____ years experience.

Name _____
Address _____
City _____
Zone____State _____

AERODYNAMICISTS

Raytheon needs aerodynamicists at all levels of experience to design and develop guided missiles for its Army, Navy, and Air Force contracts.

We offer

New modern facilities.
Expanding departments.
Recognition and advancement.
Excellent working conditions

Come in, write or call

G. P. O'NEIL
CRestview 4-7100, Ext. 224

RAYTHEON MISSILE SYSTEMS DIVISION
BEDFORD, MASS.

Take command of your future

FLY AS A CO-PILOT *WITH* TWA

Your future is yours to command when you fly as a TWA co-pilot. You'll be flying the world's finest equipment with the world's finest airline.

JUST LOOK AT THESE ADVANTAGES — starting salary of $400 from first day of training; beginning with the third year, co-pilots receive monthly base pay and guarantee of 60 hours of flight pay; annual sick leave; paid vacation; liberal free transportation for you and your family each year; retirement plan; group insurance and many more.

QUALIFICATIONS: Aged 22 to 30; between 5'8" and 6'2"; can pass TWA physical. Must have: 400 hours total pilot time; CAA Commercial Certificate and sufficient instrument time to qualify for Instrument Rating. Two years of college or equivalent; Radio Telephone Permit Third Class

There's a wonderful future waiting for you with TWA. Get your letter off today to: Mr. R. Paul Day, Employment Manager.

TRANS WORLD AIRLINES
MUNICIPAL AIRPORT
KANSAS CITY, MO.

Shockwave Powerplant Development

We are developing a line of small powerplants based on a radically new concept of power generation. We have openings for one or two Mechanical or Aeronautical Engineers who wish to work with a small group destined to expand rapidly. Graduate Engineers with some experience in Diesel or Gas Turbine design or development desired. Broad responsibilities and highly creative work.

Located in modern plant in N.E. Phila. Please send resume to Mr. R. S. Roberts — Personnel Dept., I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Phila., Pa.

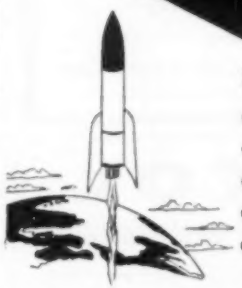
I-T-E

99.07%

ENGINEERS AND DESIGNERS

STAY WITH AC

THE ELECTRONICS DIVISION
GENERAL MOTORS



Pioneering Opportunities in the Following Fields!

- **Missile Guidance**
- **Avionics**
- **Automotive-Aviation Electronic Products**
- **Computers**
- **Jet Engine Fuel Controls**

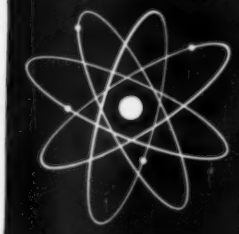
AC turn-over figures are amazing. Less than 1%! Speaks highly for the advancement opportunities, working conditions and wages we pay our Engineers and Designers. It's been that way for years at AC. That's why we are so proud of and why you should investigate your Better Future at AC by writing G. M.'s long-standing policy of decentralization creates unlimited opportunities for qualified Electrical, Mechanical Engineers and Designers. Masters Degree Program available at University of Wisconsin, Milwaukee to all eligible AC Engineers. Arrange a personal confidential interview in your locality by writing

For Employment Application
Mr. John F. Heffinger, Supervisor of Salaried Personnel

AC the ELECTRONICS DIVISION
GENERAL MOTORS CORPORATION
Flint 2, Michigan **Milwaukee 2, Wisconsin**

AVIONICS OPPORTUNITIES

In Sunny, Tropical San Diego, California



SYSTEMS ENGINEERS	FOR **NEW** AIRBORNE NAVIGATIONAL SYSTEMS
SYSTEMS ANALYSTS (engineering and mathematics)	
CIRCUITRY DESIGN ENGINEERS	MISSILE GUIDANCE SYSTEMS
SERVO DESIGN ENGINEERS	
COMPONENT PACKAGING ENGINEERS (mechanical and electrical)	HELICOPTER INSTRUMENTATION
ETCHED CIRCUIT DRAFTSMEN	AIRCRAFT CONTROL SYSTEMS
MICROWAVE TECHNICIANS	

Work on these challenging projects at RYAN
Live in beautiful San Diego—a year-round playground

WRITE TO JAMES KERNS, ENGINEERING DIVISION

RYAN AERONAUTICAL COMPANY
2711 Harbor Drive, San Diego 12, California

Engineers

FABRICATION ENGINEER

This is your chance to enjoy the exceptional professional advantages and personal benefits of a key position at General Electric's famed Jet & Rocket Engine Center.

You need a BS degree in Mechanical Engineering or Engineering Physics, plus 2 years of aircraft production design, 2 years of manufacturing engineering and 2 years of production engineering in precision work.

You will—Develop manufacturing processes for advanced aircraft engines to reduce weight, cost and materials — Evaluate designs — Develop appropriate tooling — Demonstrate the feasibility of the processes developed — and advance professionally faster and further at this modern, highly-equipped Division of General Electric.

Send resume in confidence to:

Mr. Mark Peters, Dept. 8-11
Technical Personnel, Bldg. 100
Aircraft Gas Turbine Division

GENERAL ELECTRIC
Cincinnati 15, Ohio

ENVIRONMENTAL ENGINEERS

Challenging opportunities in environmental research and development. Interesting assignments in the field of inertial navigation including:

Shock and Vibration studies
High and Low Temperature Investigation
Component evaluation

Salary—up to $12000
(Commensurate with experience)

Please send resume in confidence to:

Manager of Technical Personnel, Dept. 674

ARMA

Division American Bosch Arma Corp.
Roosevelt Field, Garden City, L. I., N. Y.

VTOL

AERONAUTICAL ENGINEERS

Unusually interesting design and development positions available in:

AERODYNAMICS
STRUCTURAL DESIGN
STRESS ANALYSIS
MECHANICAL DESIGN
ENGINEERING DRAFTSMAN

For immediate work on New Prime V T O L Aircraft Development Program.

Send resume to

DOAK AIRCRAFT CO., INC.
22309 So. Western Ave., Torrance, Calif.
Attn: Mr. N. E. Nelson, Chief Engineer

DOAK AIRCRAFT CO., INC.

AERONAUTICAL ENGINEER

An Eastern University has opening for head of established helicopter and VTOL Research Program.

Salary commensurate with experience and ability.

Please write P-2566, Aviation Week
Class. Adv. Div. P.O. Box 12, N. Y. 36, N. Y.

YOUR ORGANIZATION

Is it complete?
Are you expanding it?
Making Replacements?

Naturally, you are anxious to secure the most suitable man or men available. You want men with the special training that will make them an asset to your organization. You can contact such men through an advertisement in the Employment Opportunities Section of AVIATION WEEK.

Classified Advertising Division—

AVIATION WEEK
330 W. 42nd St.,
New York 36, N. Y.

ENGINEERS needs SPECIFICATION WRITERS (Technical)

Knowledge of Military Specifications and formats required. Should be familiar with functional and environmental testing of specialized electro-mechanical, electronics equipment. Must be capable of interpreting engineering drawings. Some engineering experience or formal engineering education is desirable.

GM INERTIAL GUIDANCE SYSTEM PROGRAM ELECTRONICS DIV.,

Milwaukee 2, Wis.

Enjoy Challenging Opportunities in the most versatile Laboratories in the country. Work with the top men in the field and with the finest test, research and development facilities. We are in the process of a Major, Permanent, Expansion Program. New Plant facilities being added in suburban Milwaukee area.

To aid you in your professional advancement AC will provide financial assistance toward your Master's degree. A Graduate Program is available evenings at the University of Wisconsin, Milwaukee.

GM's Electronics Division aggressive position in the field of manufacture and GM's long-standing policy of decentralization creates individual opportunity and recognition for each Engineer hired.

Recent EE,ME Graduate Inquiries Also Invited

Milwaukee offers ideal family living in a progressive neighborly community in cool, southern Wisconsin where swimming, boating, big league baseball and every shopping and cultural advantage is yours for the taking.

To arrange personal, confidential interview in your locality send full facts about yourself today to

Mr. John F. Heffinger
Supervisor of
Salaried Personnel

AC

Electronics Div.
General Motors Corp.
Milwaukee 2, Wis.

To the Superior Physicist and Electronics Engineer Interested in Avionics and Industrial Television

We invite you to consider the outstanding career opportunities currently available in the avionics and industrial television fields at General Precision Laboratory, one of the companies in the GPE Group.

Check these aspects of employment at GPL:

● *Projects.* GPL offers assignments in both the military and commercial phases of avionics, electronics and television. You may work on missile guidance; navigation and bombing systems of both the Doppler and inertial types; radar; analog and digital computers; simulators and trainers; airborne data-processing systems; motion picture projection equipment and many aspects of the design and manufacture of broadcast, military and industrial television equipment. The scope of its research, development and production activities in wide areas enables GPL to offer a variety of assignments within the flexible structure of one organization.

● *Some GPL Achievements.* GPL is at the forefront of research, design, development and production in a number of fields. Its AN/APN-66 family of self-contained air navigation systems has been in scheduled production for more than a year. In millions of operational miles in Air Force and Navy bombers, transports, patrol craft and hurricane hunters, they have demonstrated the best system accuracies ever achieved by global navigators. They have recently been made standard equipment for additional types of military craft and their still further application to planes, bombing systems and guided missiles is anticipated. In the civilian field, GPL's RADAN Systems promise to solve the vital navigational problems of the jet air liners.

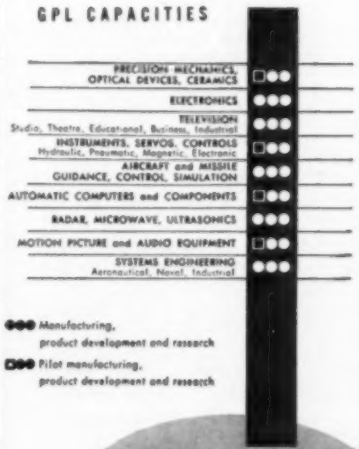
● Among other GPL successes have been the pioneer research and development of stereophonic sound for motion-picture theatres, and the GPL video recorder, with its remarkable electronic shutter, found in 90 per cent of the recorder-equipped TV stations in the country. GPL's extremely compact, highly sensitive *it*-TV camera—and widely used TV projector which throws bright, clear TV pictures onto wall-size screens—have opened new fields to closed-circuit television.

● *Organization.* GPL is organized in compact functional units, each located in its individual building on a former estate in Westchester County. A pleasant environment and freedom for laboratory research and development supplant the administrative burdens and impersonal atmosphere frequently found in large engineering organizations. Facilities and equipment are the most modern available. And, because GPL is a member of the General Precision Equipment Group, you are part of a nationwide organization with plants from coast to coast.

● *Policies.* At GPL there are only two criteria that control your progress: your ability and your performance. Your achievements are promptly recognized and rewarded. Salaries and fringe benefits are outstanding. Generous financial assistance is provided for relocation expenses.

● *Location.* You and your family may live as you choose in the city, suburban or country areas of Westchester County free from the pressures of metropolitan living and without commuting problems. Westchester has long been famed for its educational, cultural and recreational resources. New York City, world center for professional meetings, museums, theatres, sports, is less than 1 hr. away.

Investigate these unusual career opportunities with this pioneer and leader in the avionics and television equipment fields. To arrange for a personal discussion of your future at GPL write to: G. H. Orgelman, Personnel Director. All inquiries will be acknowledged and held in strictest confidence.



GPL

GENERAL PRECISION LABORATORY INCORPORATED

63 BEDFORD ROAD,
PLEASANTVILLE, NEW YORK

A SUBSIDIARY OF GPE

• RADIO COMMUNICATION SYSTEMS • INFRARED • DIGITAL TECHNIQUES • DATA SYSTEMS • MICROWAVE CIRCUITS • MECHANICAL DESIGN ENGINEERING • NAVIGATIONAL SYSTEMS • AUTOMATIC TEST SYSTEMS • MILITARY TRANSISTOR APPLICATIONS • COUNTERMEASURES • RADAR • RADIO COMMUNICATION SYSTEMS • MISSILE GUIDANCE SYSTEMS • DATA SYSTEMS

ELECTRONIC ENGINEERS

Stromberg-Carlson, a Division of General Dynamics Corporation, is located in the Finger Lakes region of upstate New York. In addition to providing a wide variety of challenging engineering opportunities, excellent salaries are offered with the finest working conditions in a modern electronics laboratory. Unusual recreational and educational facilities are available in this medium-sized progressive city, and fine residential areas are located within a mile of the plant. Because of the variety of its product line, which is approximately equally divided between military and civilian, Stromberg-Carlson offers a degree of stability and an opportunity for advancement unequalled in the industry. Openings:

Radio Communication Systems **Data Systems** **Digital Techniques**
Microwave Circuits **Mechanical Design Engineering** **Infrared**
Automatic Test Systems **Countermeasures** **Navigational Systems**
Military Transistor Applications **Radar** **Missile Guidance Systems**

Write or call collect:

C. W. Finnigan, Chief Electronics Engineer

STROMBERG-CARLSON COMPANY
A DIVISION OF GENERAL DYNAMICS CORPORATION
125 CARLSON ROAD, ROCHESTER 3, N. Y.

S-C STROMBERG-CARLSON

A Senior Technical Management Opportunity IN Instrumentation Development for Missile Test

The engineer or scientist with senior technical management experience in the field of instrumentation is invited to consider association with our Staff as Head of the Instrumentation Department.

The Department Head will direct a broad program of instrumentation systems development for guided missile test. This responsibility includes supervising these projects:

- **Planning instrumentation systems for specific missile tests.**
- **Studying the limitations and capabilities of instrumentation systems.**
- **Investigating new instrumentation developments.**
- **Initiating research and development programs.**

Among the forms of instrumentation involved are optics, telemetry, infra-red, radar, and sonar.

Please address inquiries regarding this position to:

P-2769, Aviation Week
Classified Adv. Dept.,
P. O. Box 12, New York 36, N. Y.

ENGINEERS, SCIENTISTS, DESIGNERS

Outstanding Opportunities Available

The types of work on which you could be engaged include:

Missiles
Applied Mechanics
Geophysics
Underwater Ordnance
Electronic Countermeasures
Digital & Analog Computers
Instruments and Controls
Solid State Physics
Microwaves & Antennas
Infra Red Systems
Inertial Systems
Servomechanisms
Balloon Systems
Industrial Automation
Upper Atmosphere Research
Fine Particle Technology
Surface Chemistry
Optics
Mechanical Design
Airborne Early Warning
Radar Systems
Information Theory
Systems Analysis and Design
Electronic Equipment Design and Miniaturization

You can grow with our dynamic and progressive research and development activity in its long-term expansion. We are prime systems contractor for several major programs in which new groups are being formed and which create ground floor opportunities for you. We have excellent facilities and equipment and can use people to the fullest extent of their capacity, with encouragement and opportunity to advance further. You can work closely with prominent engineers and scientists. Our managerial positions are staffed by people with technical engineering backgrounds. You do not become isolated on a small part or component but contribute to and become an integral part of a significant program. Congenial associates and atmosphere. Our people tell us they enjoy their work, and our extremely low turnover rate testifies to this. Tuition re-imbursement plan includes University of Minnesota three minutes away. Delightful residential communities close to work, fine cultural environment, recreational areas, fishing, hunting, boating, winter and summer sports. Live in the Land of Sky Blue Waters. Permanent security with a stable, long-established company whose motto is "The Future is Our Frontier." Salaries recognize experience for all levels of positions. Relocation expenses. We believe we have all the opportunities you could find anywhere in the country.

Engineers—Electronic, Electrical, Aeronautical, Mechanical, Chemical
Physicists, Meteorologists, Physical and Electro *Chemists*
Junior, Associate, and *Senior* grades, from Bachelor through Doctorate degrees.

All inquiries will be treated in complete confidence.

You are invited to address* PETER BURGESS, *Director of Personnel,

Mechanical Division of General Mills, Inc.,
1620 Central Ave. N.E., Minneapolis 13, Minnesota.

NEED ENGINEERS

Place an "Engineers Wanted" advertisement in this EMPLOYMENT OPPORTUNITIES section. *It's an inexpensive, time saving method of selecting competent personnel for every engineering job in the Aviation industry.* The selective circulation of AVIATION WEEK offers you an opportunity to choose the best qualified men available throughout the industry.

TEST ENGINEERS

DO YOU LIKE YOUR ENVIRONMENT?

Investigate the Environment created at AC for its Advanced Development Programs on Missile Guidance and Aircraft Fire Control Systems.

OUR ENVIRONMENTAL LABORATORY

is one of the most Versatile Laboratories in the country and is in the process of a Major, Permanent Expansion. Men hired will enjoy working with the finest of test equipment and facilities, together with top men of the field.

We are currently engaged in the following Types of Test Activities:

VIBRATION TESTING
COMPLEX WAVE ANALYSIS
LOW TEMPERATURE - ALTITUDE
HIGH TEMPERATURE
RELIABILITY EVALUATION
INSTRUMENTATION

Write Mr. J. Heffinger
Supervisor of Salaried Personnel

AC
The Electronics Div.
General Motors Corp.
Milwaukee 2, Wis.

OXYGEN ENGINEER

Top Career Opportunity for creative research in design, development of aircraft oxygen systems.

Top Rated Company with nationwide organization, 45 year history of steady growth.

Top Caliber Man, graduate engineer, 30-45, experienced, will start at salary merited by qualifications, advance according to ability and ambition. Give complete resume—replies confidential.

"Pioneers in oxygen breathing systems for aircraft"

PURITAN COMPRESSED GAS CORP.
2012 Grand Ave. Personnel M-1 K. C., Mo.

EXPANDING HELICOPTER PASSENGER PROGRAM HAS OPENINGS FOR:
- **Passenger Reservations Personnel**
- **Supervising Accountant and Auditor Statistician**

Airline Experience Required. Address Reply To:

LOS ANGELES AIRWAYS, INC.
Box 45155, Airport Station,
Los Angeles 45, California

AIRCRAFT STRUCTURAL ENGINEER

Minimum of 3 years' experience in preliminary design, structural design, or stress to work in group monitoring an over-all aircraft project.

There is vast opportunity for professional recognition at Raytheon's new Wayland Laboratory, where Aeronautical, Mechanical, and Electronic Engineers work as a team, developing complete aircraft weapons systems.

A brief resume form and a copy of the brochure pictured above may be obtained by sending your name and address to:

RAYTHEON

RADAR PROFESSIONAL PERSONNEL
RAYTHEON MANUFACTURING CO.
WAYLAND LABORATORY **Wayland, Mass.**

Mechanical Engineer

SPECIFICATIONS SPECIALIST

This is an especially good opportunity for you to gain the exceptional professional and personal advantages enjoyed by engineers at General Electric's Jet & Rocket Engine Center.

Your degree should be preferably a BSME, your technical ability sufficient to comprehend the specifications data, and your abilities with people sufficient to coordinate the efforts of many groups. Experience in aircraft gas Turbines, specifications or technical reports would be desirable.

You will be responsible for carrying out programs for: preparing, issuing, and maintaining advanced engine Model and Test Specifications; continuously reviewing engineering changes and test results as they effect specifications' and initiating corrective action; and preparing reports—all to assure engineering compliance with specifications requirements.

Please send resume in confidence to:

Mr. Mark Peters, Dept. 8-6
Technical Personnel, Bldg. 100
Aircraft Gas Turbine Division

GENERAL ELECTRIC

Cincinnati 16, Ohio

GAMBLE?

sure . . . if the odds are in YOUR favor . . .

DECISION/INC—nationwide specialists in recruitment of engineering personnel—have an active and enviable record in developing job opportunities for men who want bigger salaries and a chance for greater personal achievement.

DECISION/INC is retained by more top-ranking firms thruout the nation than any other organization to *find the right man* for each job. This confidential service costs you nothing.

It takes TIME—MONEY—EFFORT to improve your job situation. If you are an engineer or scientist, particularly in the ELECTRONIC—AERO-NAUTICAL or GUIDED-MISSILE field, DECISION/INC will do this **quickly, effectively at no cost to you.**

HOW? Our placement specialist develops a plan "tailor-made" for you —which includes a resume of your experience . . . and then a review by selected companies leading to confidential interviews at **your** convenience and **our** client's expense.

NOW is the time for DECISION!
All you do Now is . . . send us your name, home address, job interest or title. We take it from there.

Write or phone:
OLIVER P. BARDES,
President—
DECISION/INC
1460-7 FIRST NATIONAL BANK BLDG.
CINCINNATI 2, OHIO
GArfield 1-1700

Publishers of the authoritative Engineers' Job Directory

Engineers

CONTINENTAL

OFFERS YOU A WIDE FIELD FOR SPECIALIZATION

Steady expansion of both research and production facilities at Continental Aviation & Engineering Corporation creates an increasing demand for qualified engineering personnel. Liberal salary benefits and a wide range of project activities on all phases of reciprocating and turbine engine development are yours when you join the Continental staff. . . . If you hold a degree in engineering, physics or mathematics, contact CAE at the address below and investigate the opportunities that can be yours.

ADDRESS: "Salaried Personnel"

CONTINENTAL AVIATION & ENGINEERING CORPORATION
1500 ALGONQUIN AVE., DETROIT 15, MICHIGAN
SUBSIDIARY OF CONTINENTAL MOTORS CORPORATION

DOMAN

offers ground floor growth opportunities to experienced engineers for these attractive positions.

HELICOPTERS, INC.

- Chief of Structures
- Senior Stress Engineer
- Weights Group Engineer
- Rotor Design Engineer
- Fuselage Design Engineer

This is an opportunity to join a small company which is on the threshold of a major expansion. We want engineers who welcome the challenge and professional growth potential offered through working on new R & D projects.

Danbury is located just 65 miles from New York City and offers ideal family living in pleasant surroundings.

To arrange for a personal interview please send a complete resume to:

W. J. HATCHER
Director, Industrial Relations,
Doman Helicopters, Inc.
Danbury, Connecticut

FOR RATES OR INFORMATION

About Classified Advertising,

Contact The McGraw-Hill Office Nearest You.

ATLANTA, 3
1321 Rhodes-Haverty Bldg.
WAlnut 5778
R. POWELL

BOSTON, 16
350 Park Square
HUbbard 2-7160
H. J. SWEGER

CHICAGO, 11
520 No. Michigan Ave.
MOhawk 4-5800
W. HIGGENS
J. BRENNAN

CINCINNATI, 37
1825 Yorktown Road
Swifton Village, Apt. 2
G. MILLER

CLEVELAND, 15
1510 Hanna Bldg.
SUperior 1-7000
W. SULLIVAN

DALLAS, 2
Adolphus Tower Bldg.,
Main & Akard Sts.
PRospect 5064
D. BILLIAN

DETROIT, 26
856 Penobscot Bldg.
WOodward 2-1793
W. STONE

LOS ANGELES, 17
1125 W. 6 St.
MAdison 6-9351
C. F. McREYNOLDS

NEW YORK, 36
330 West 42 St.
LOngacre 4-3000
S. HENRY
D. COSTER
R. LAWLESS
R. HATHAWAY

PHILADELPHIA, 3
17th & Sansom St.
RIttenhouse 6-0670
H. BOZARTH
E. MINGLE

ST. LOUIS, 8
3615 Olive St.
JEfferson 5-4867
W. HIGGENS

SAN FRANCISCO, 4
68 Post St.
DOuglas 2-4600
W. WOOLSTON

Deal Directly with Owner

C18 and D18 BEECHCRAFT FOR LEASE

No deposit required—no long-term contract.

- Executive appointments
- Well equipped radio
- Full instrumentation
- Good selection

$300 monthly and up. Fly all you like. Aircraft built insurance included. If desired aircraft available for outright purchase

TRADE-AYER COMPANY
Linden Airport Linden, N. J.
Hunter 6-7690

SEARCHLIGHT SECTION

(Classified Advertising)

BUSINESS OPPORTUNITIES EQUIPMENT - USED or RESALE

UNDISPLAYED —RATES— **DISPLAYED**

$2.10 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Box Numbers count as one line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

The advertising rate is $21.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns, 30 inches to a page.

Closing Date: 11 days before issue date, subject to space limitations.

Send New Ads to Classified Advertising Div. of AVIATION WEEK, P. O. Box 12, New York 36, N. Y.

FOR SALE LOCKHEED L-10

P & W SC1 1340 Engines less than 500 Hrs Since New Airline Interior; Lavatory—Radio—VHF—HF—ADF 9 Seats & Lounge for 3 (12 Passengers) Individual Air Vents & Fans—Extra Engine and Spares Available

CALIFORNIA CENTRAL AIRLINES
HANGAR No. 3 Lockheed Air Terminal
Burbank, California

JET ENGINES
Westinghouse Type—J-30-20
FOR SALE At
TEXAS AVIATION MATERIAL
3930 Cedar Springs Dallas 19, Texas

FOR SALE
EXECUTIVE DC-3
Excellent Radio & A-12 Auto Pilot
R-1830-75 Engines
Available Immediately No Brokers Write
FS-2571, Aviation Week
520 N. Michigan Ave., Chicago 11, Ill.

BEECHCRAFT D18S
For Sale or Lease
Hydromatic Props. Fully Equipped and ready to go. Call us for a demonstration.
GEORGE H. BAILEY COMPANY
3308 Quimby Arcade, Fort Wayne, Indiana

AIRCRAFT PRODUCTS WANTED FOR MANUFACTURE
Will buy outright—Prints; Tooling; Parts; Etc., also Corporate Setup
A-N proprietary items especially wanted.
COLLINS AIRCRAFT CORPORATION
1711 W. Florence Ave. Inglewood, California

AIRPLANES WANTED
Need 50 Bonanzas, Navions, 180's, 170's, 170's, Aero Commanders, Twin Navions, Twin Beeches, etc.
Will Buy Dealers' Stocks New or Used
Vest Aircraft Co.'s Skyranch
BOX 5306, DENVER 17, COLORADO

WANTED
CONVAIR 240 or 340
Send Complete Information and Price to—
W-2368, Aviation Week
1125 W. 6th St., Los Angeles 17, Calif.

WANTED
LINK TRAINER C-8
Please write giving price and full information to
W-2743, Aviation Week
Class. Adv. Div. P.O. Box 12, N.Y. 36, N.Y.

MARTIN 202

IDEAL FOR AIR BORNE ELECTRONIC TEST BEDS

FOR SALE

Fast - quiet — the fastest and quietest of post-war twin-engine aircraft (270 m.p.h.).

Spacious cabin — will provide executive interior of superlative size (9½' wide x 7' tall x 33½' long).

Modern — low-wing, flush riveted, tricycle gear, built-in hydraulic steps at rear.

In excellent condition — operated in scheduled airline service (engines zero T.S.O.).

REASONABLY PRICED — Will also consider long-term lease.

This aircraft identical to others currently used by scheduled airlines. Believe scheduled airline maintenance can be secured. All airworthiness directives current. Send inquiries direct to owners —

PIONEER AERONAUTICAL SERVICES
615 Meadows Bldg. • Dallas, Texas • FOrest 8-6182

C-46F FOR LEASE

50 Passenger interior. Payloader seats can be used for Cargo or Passenger operation. Now in service. Available August 15th.

We own this Aircraft

NATIONAL AERO LEASING CORP.
P. O. Box 184, Miami 48, Fla.
Newton 5-0734

FOR SALE

Beechcraft D18S $38,500.00

Hydromatic propellers
Collins radio & ARC course director
Five-place cabin (beige & tan)
De-icer boots
Hi-intensity nav. lights
Grimes rotating beacons

Executive Aircraft Service, Inc.
P. O. Box 7307, Dallas 9, Texas
***Telephone:* FAirdale-2675**

DC-3's
FOR SALE

We own several DC-3 21 seat airliners, fully equipped, which we are offering for sale. Aircraft are available for immediate inspection at Miami International Airport.

We are owners.

LEEWARD AERONAUTICAL SALES, INC
P.O. BOX 233, MIAMI 48, FLA.

HELICOPTER
Hiller—Model UH-12B. Very low airframe and engine time.
Perfect Condition.
EAST COAST AVIATION CORPORATION
Bedford Airport Lexington 73, Mass.

DOUGLAS C-54-E

3600 GALLON FUEL SYSTEM
73,000 LB. GROSS TAKE OFF WEIGHT
CARGO DOOR & CARGO FLOOR

CASH SALE or WILL FINANCE

ZERO TIME

AIRFRAME - R2000-7M2 ENGINES - PROPELLERS -
COMPONENTS - COMPLETE AIRLINE RADIO & INSTRUMENTS

15 DAY DELIVERY

ALSO ZERO TIME R2000-7M2 ENGINE & BUILDUP
DIRECT SALE BY OWNER
WIRE - CABLE - WRITE
FS-2753, Aviation Week
68 Post St., San Francisco 4, Calif.

Immediate Delivery
We stock, overhaul, and install

WRIGHT	PRATT & WHITNEY
R1820 –202, –56, –72	R1830 –75, –92, –94

R2000 R1340 R985
and our most popular DC3 engine
R1830 - SUPER - 92

ENGINE WORKS
Lambert Field Inc. St. Louis, Mo.

SPECIAL SERVICES TO THE AVIATION INDUSTRY

FOR SALE OR LEASE
CARGO C-47=
heavy gear—24 volts
heavy wing doublers
1830—92 engines
13,426. hours total—1023.00 since overhaul
we own this aircraft
NATIONAL AERO LEASING CORP.
P. O. Box 184, Miami 48, Fla. Newton 5-0734

FOR SALE
C-47
Cargo Plane NTSO
Center Section & Wing Modification
Fire Prevention—92 Engines
Inspect and Compare
Phone Beverly Hills, California
BRadshaw 2-4609
FS-2727, Aviation Week
68 Post St., San Francisco 4, California

OVERHAUL & MAINTENANCE

Remmert-Werner

Inc. of St. Louis	Inc. of Florida	Inc. of Toledo
Lambert Field	Pompano Beach Airport	Express Airport
Maintenance	Conversion	Overhaul

Specialists in Lodestar **DC3** Beech

RAS INCORPORATED
"Take a Heading for Reading"
for the BEST MAINTENANCE • OVERHAUL • MODIFICATION • INSTALLATION
READING AVIATION SERVICE, INC.
Municipal Airport Phone 3-3255 Reading, Pennsylvania

CARTER AVIATION
Byrd Airport, Richmond, Va.
C.A.A. Approved Repair Station No. 4260
Class 1 & 3 Airframe No Limitations
Power Plant Limited
AERO-COMMANDER SPECIALIZED SERVICE
By appointment only
P. O. Box 6097 Ph. Fairfield 4670

SINCE 1937 **Page AIRWAYS, Inc.**
FINEST AIRCRAFT MAINTENANCE
100 HR. INSPECTIONS
COMPLETE OVERHAUL
TWIN BEECH
DC-3
LODESTAR
ROCHESTER AIRPORT
PHONE GENESEE 7301 • ROCHESTER 11, N.Y.

PARTS & SUPPLIES

NAVCO INC.
Lambert Field
St. Louis, Mo.
PErshing 1-1710
Has all Parts and Supplies for Executive
DC-3 LODESTAR BEECH
Airframe Engines Radios
A.R.C. Bendix Collins Lear Sperry Wilcox
P&W Continental Wright Goodrich Goodyear

now available!
WINSLOW FULL-FLOW
OIL FILTERS
FOR P&W R-2800
INSTALLATIONS
. . . other models for R-985, R-1340, R-1820, R-1830, R-2000, and R-2600 installations.
Write or wire . . .
STEWARD-DAVIS Inc.
13501 S. Western • Gardena, Calif.
Telephone: FAculty 1-3414

WORLD'S FOREMOST
LODESTAR
SERVICE CENTER
Inspection | Radar
Maintenance | Interiors
Instrumentation | Engine Change
Modification | Exteriors
Overhaul | Radio
LEAR
AIRCRAFT ENGINEERING DIVISION
Santa Monica Airport, Santa Monica, California
Builders of the Incomparable Learstars

CONNECTORS
STOCK DELIVERY — AUTHORIZED DISTRIBUTOR
BENDIX CANNON IPC WINCHESTER
2102 Market St., Phila. 3, Pa., LO 7-5285
HAROLD H. POWELL CO.

OXYGEN EQUIPMENT
SALES & SERVICE
REGULATORS — MASKS — VALVES
PORTABLES & CYLINDERS
FIXED INSTALLATIONS
GOV'T. APPROVED REPAIR STATION
ZEP AERO
Phone: ORegon 8-1161
EL SEGUNDO, CALIFORNIA

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—AUGUST 27, 1956

AERO DESIGN & ENGINEERING COMPANY....17, 56
Agency—Tom P. Gordon Co., Adv.

AEROJET-GENERAL CORPORATION 58, 59
Agency—D'Arcy Adv. Company

AEROQUIP CORPORATION 7
Agency—The Fred M. Randall Company

AIRPORT DIRECTORY 91

ALL AMERICAN ENGINEERING CO..... 4
Agency—Gaynor, Colman, Prentice & Varley, Inc.

BASCH CO., GEORGE..... 77
Agency—Davis, Parsons & Strohmeier, Inc.

CESSNA AIRCRAFT COMPANY..... 9
Agency—Gardner Advertising Co.

CLEVELAND PNEUMATIC TOOL COMPANY..... 14
Agency—Meldrum & Fewsmith, Inc.

COLOR TELEVISION, INC..... 44
Agency—Sturges & Associates

COLLINS RADIO COMPANY.....78, 79
Agency—W. D. Lyon Co., Inc.

CONNECTICUT HARD RUBBER COMPANY..... 81
Agency—Troland, Inc.

CONTINENTAL MOTORS CORP..... 69
Agency—The Hopkins Agency

CONVAIR—DIV. OF GENERAL DYNAMICS..2nd Cover
Agency—Buchanan & Co., Inc.

CORNELL AERONAUTICAL LABORATORIES, INC. 60
Agency—Barber & Drullard

DOW CORNING CORPORATION..... 15
Agency—Church & Guisewite, Adv.

EDO CORPORATION 77
Agency—Davis, Parson & Strohmeier, Inc.

ELASTIC STOP NUT CORP. OF AMERICA...4th Cover
Agency—G. M. Basford Company

ELECTRICAL ENGINEERING & MFG. CORP..... 35
Agency—West-Marquis, Inc.

ELGIN NATIONAL WATCH CO. ORDNANCE DIV.. 18
Agency—Waldie & Briggs, Inc.

ENJAY CO., INC..... 36
Agency—McCann-Erickson, Inc.

FAIRCHILD ENGINE & AIRPLANE CORP..... 3
Agency—Gaynor, Colman, Prentis & Varley, Inc.

GENERAL ELECTRIC COMPANY.....10, 11
Agency—G. M. Basford Company

GENERAL ELECTRIC CO., LAMP DIVISION..... 67
Agency—Batten, Barton, Durstine & Osborn, Inc.

GOODRICH CO., THE B. F., AVIATION PRODUCTS 20
Agency—Batten, Barton, Durstine & Osborn, Inc.

GOODYEAR AIRCRAFT CORP.....54, 55
Agency—Kudner Agency, Inc.

HEXCEL PRODUCTS, INC..... 6
Agency—Peter Hurst Advertising, Inc.

KAMAN AIRCRAFT CORP., THE..... 64
Agency—Charles Palm & Co.

KIDDE & CO., INC., WALTER..... 22
Agency—Cunningham & Walsh, Inc.

KOEHLER AIRCRAFT PRODUCTS CO..... 52
Agency—Wilson, Haight, Welch & Grover, Inc., Advertising

LOCKHEED AIRCRAFT CORP..... 8
Agency—Foote, Cone & Belding

LOCKHEED AIRCRAFT CORP., GEORGIA DIV.... 84
Agency—Donahue & Coe, Inc.

McGRAW-HILL PUBLISHING CO.....92, 93

MICRO SWITCH DIV. OF MINNEAPOLIS-HONEYWELL REGULATOR CO 74
Agency—Reincke, Meyer & Finn, Inc.

MILLS MANUFACTURING CORP.....105
Agency—Burnley Weaver Adv.

NEW DEPARTURE DIV., GENERAL MOTORS CORP. 24
Agency—D. P. Brother & Co., Inc.

NORTH AMERICAN AVIATION, INC., COLUMBUS DIV. 72
Agency—Batten, Barton, Durstine & Osborn, Inc.

PACIFIC SCIENTIFIC CO..... 80
Agency—The Martin R. Klitten Co., Inc.

PASTUSHIN INDUSTRIES, INC..... 88
Agency—Western Advertising, Inc.

PHILLIPS PETROLEUM CO..... 5
Agency—Lambert & Feasley, Inc.

RESEARCH WELDING & ENGINEERING CO., INC. 88
Agency—Dan Ebberts Advertising

ROBINSON CO., RALPH C.....105
Agency—Chapin-Damon Adv.

ROHR AIRCRAFT CORP..... 94
Agency—Barnes Chase, Inc.

RYAN AERONAUTICAL COMPANY..... 56
Agency—Batten, Barton, Durstine & Osborn, Inc.

RYERSON & SON, INC., JOSEPH T 88
Agency—Calkins, Holden, Carlock, McClinton & Smith, Inc.

SENSENICH CORP. 61
Agency—Foltz-Wessinger, Inc.

SHAFER BEARING DIV., CHAIN BELT COMPANY 12
Agency—The Buchen Company

SOCONY MOBILE OIL CO., INC. 88
Agency—Compton Advertising, Inc.

SOLAR AIRCRAFT COMPANY..... 13
Agency—The Phillips-Ramsey Co. Adv.

SOUTHERN CALIFORNIA CO-OPERATIVE WIND TUNNEL 90
Agency—Perrot Corp.

SPERRY GYROSCOPE CO., DIV. THE SPERRY RAND CORP. .....3rd Cover
Agency—Beach, Yates & Mattoon, Inc.

STEWART WARNER CORP. (ELECTRONICS DIV.) 73
Agency—The Buchen Co.

THOMPSON AIRCRAFT TIRE CORP..... 53
Agency—Norton M. Jacobs Adv. Agency

WHITTAKER CO., LTD., W. R..... 68
Agency—Mogge-Privett, Inc.

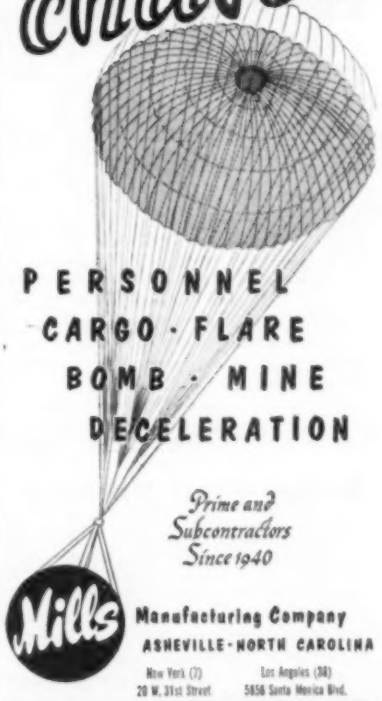
WYANDOTTE CHEMICALS CORP..... 16
Agency—Brooke, Smith, French & Dorrance, Inc.

CLASSIFIED ADVERTISING

F. J. Eberle, Business Manager

EMPLOYMENT OPPORTUNITIES 95-102
SPECIAL SERVICES TO THE INDUSTRY.....104
PLANES—EQUIPMENT (Used or Surplus New) For Sale 103, 104
WANTED Equipment 103

'chutes

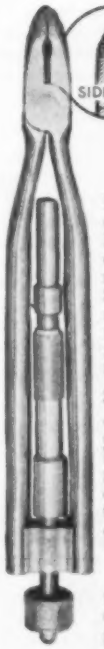


PERSONNEL
CARGO · FLARE
BOMB · MINE
DECELERATION

Prime and Subcontractors Since 1940

Mills Manufacturing Company
ASHEVILLE · NORTH CAROLINA
New York (7) 20 W. 31st Street
Los Angeles (38) 5656 Santa Monica Blvd.

Now! . . . the NEW
ROBINSON WIRE TWISTER
with DIAGONAL GRIP-HEAD



Faster, more efficient than ever! The new, slendernose DIAGONAL GRIP-HEAD is designed especially for those narrow- hard-to-reach places. Split-second whirling action safety-wires 3 engines in time required for one by any other method . . . saves as much as $140 per engine assembled.

3-TOOLS-IN-1 . . . pliers-cutters-twisters. Side-cutting, oil-tempered head. Permanent bronze bearing. No adjustments. Jaws lock on wire, can't slip off. Perfect, uniform twist every time.

12" —for assembly line safety wiring, 15 oz. $21.50
9" —for bench work, sub-assemblies, 12 oz. $20.50

Unconditional Money-Back Guarantee. Send for complete details.

RALPH C. ROBINSON CO.
Box 494W No. Sacramento 15, Calif.

Canadian Distributor, Gensales, Ltd., Malton, Ont.

LETTERS

KB-50 Tanker

On p. 113, of your July 16, 1956 issue, you published a full page ad of the Hayes Aircraft Corporation and in this same issue, on p. 107, you published a picture of the KB-50 tanker under the caption "Boeing KB-50 Tanker Undergoes Three-Drogue Test at Eglin".

I believe you are aware that the Hayes Aircraft Corporation designed, engineered, prototyped and is producing the three drogue KB-50 tanker in Birmingham, and I was certainly disappointed in the story on p. 107 to find no mention of the fact that this work was done by Hayes.

Anything you might be able to do to correct this misinformation will certainly be appreciated.

LEWIS F. JEFFERS, President
Hayes Aircraft Corporation
Birmingham, Alabama

Better Pilot Practice

The tragic crash of two airliners June 30 calls for safer pilot practice and better visibility from modern planes rather than the 100% IFR proposed by airlines which would keep more than 95% of the civilian planes grounded, to give the airlines a slight extra convenience.

Many of the modern airliners have downward visibility of as low as 2 degrees and upward visibility of as low as 15 degrees from the pilots position. This is not sufficient for safe VFR flying. The airlines have the right to request IFR on most flights, yet continue to fly VFR even though they are against it.

Proper lookout is not being maintained on modern airliners flying on autopilot. As a safety factor the cockpit of airliners should be visible to passengers to ascertain that proper lookout is maintained. All the electronic marvels of our age will not give us the safety of an alert pilot flying a ship with good visibility, VFR or IFR.

One hundred percent IFR flights may offer a slight convenience to the scheduled airlines, but is a detriment to business, utility, and training flights, and I cannot see how they would increase safety in the air except by reducing the number of planes in the air.

The two planes which collided June 30 were on controlled flights or the equivalent of IFR, but that did not prevent a disaster.

OTTO F. TROUT, JR.
3533 Chesapeake Ave
Hampton, Va.

More Confusion

I have always contended that I would never write a letter to a magazine unless I felt I was in some small way an expert on the subject in question—which I am not. However, since reading Mr. George M. Sager's little masterpiece in the letters section of your July 30 edition (p. 102) I feel my 22-months-old son would be equally qualified to do this job for me.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Your statement, Mr. "Duke of Gloucester Street", I quote, ". . . it seems the larger, faster and greater number of passengers carried, the less the pilots look out the windshields of passenger planes", unquote, was spoken like a true groundling.

Of course, you didn't consider that anyone of the things mentioned in your quote would mean that there are more engines, more engine instruments, more flight instruments, faster rate of closure, less control reaction, less cockpit space, less windshield space, and considerably more confusion in the cockpit, any one of which will impose many times the strain on the same two pilots that they had in the DC-3 or you in your light plane.

I personally think that if you are a cross section of the American light plane pilot, then the only sentence of your entire letter making any sense is the second sentence of your last paragraph. Thank God, I do know that your ideas are not a cross section of my friends who are light plane pilots.

Seriously, I do suggest you climb into the cockpit of the first available DC-7 and imagine yourself going 350 mph, looking at all of the instruments, trying to give 80 passengers a good ride, and generally carrying on a good, safe operation. Then when you get through with that, help the rest of us pilots talk up enough "political money" for a safe, high altitude control system from coast to coast where we can stay out of the way of you gentlemen.

"ROD" COSTON
Carrollton, Texas

Better Visibility

With regard to the recent aircraft collision over the Grand Canyon and to the perhaps dozens of near misses daily, isn't it about time the airlines and commercial manufacturers do some soul searching relative to cockpit visibility? Certainly electronic devices will be an aid but as Mr. George M. Sager points out in your July 30 issue (p. 102), no such equipment will ever replace keen eyesight in flying. As a one time WW II fighter pilot I can attest to a creepy feeling when sitting in a typical commercial cockpit (clearly a case of aggravated claustrophobia, no doubt)—the fact is you just can't see much of what's going on outside. Thus, at the expense of appearing ridiculous, let's put the pilot, the copilot, and the flight engineer (the latter facing rearward) in a bubble enclosure and be willing to accept some slight performance penalties—we might even get some gravy in the form of increased passenger or baggage space beneath the cockpit.

C. C. JOHNSON
Arlington, Texas

Created Emergencies

Mr. Robson seems to be torn between the influence of others and self preservation, and also confused on the difference between flight checks, flight training, and emergency training. Interest stems from the loss of friends and many costly crashes in the last six years from created emergencies under 1,000 ft., not an accident or two on takeoffs.

I doubt if his or any pilot's family would get any consolation and would ask as others have, was it necessary for him to get it like that? After flying for years coping with all those hazards he has been hollering about.

If so, will it be necessary with the $5 million jets.

He should not infer to the public that this check flight is turning out pilots, as it does not prove, fully examine, guarantee or produce competent airline captains with good judgment and common sense. No one has asked that the requirements for an ATR be changed, nor the alteration of copilot training and transition upgrading to captain. The subsequent six month CAA checks on certain items is not a training ride, but a check to maintain your license. You are not a beginner at this stage; however, the companies are free to give all the flight and emergency training they desire or the pilot needs. For those that wish to fool around near the ground, cutting things for emergency possibilities when they could do it higher or in simulators, let them do it in a group on a request basis in an insured, rented plane.

The check flight with the light plane and good weather as he says (a dangerous episode with pressure, tricks, haste, kicking it around, plus personality clashes, etc.) is a long ways from the actual thing. Actually when you lose power, you call for or apply what's left. From there on it's purely power available vs weight, speed, obstructions, terrain, distance, weather, crew experience and teamwork. Recently a plane lost 3 engines (a rare occurrence) so they might as well add this to the check.

That compelling reason for cutting is a grand illusion, no one is willing to be killed on these let's-see-what-you-will-do-rides, with loss of life and license staring you in the face, for anyone else. It is a necessary CAA requirement to renew that little ticket and for which they now have indicated their willingness to allow a safer and more economical demonstration. Unadulterated training will make competent pilots out of the right people, but unadulterated chance taking will make dead ones out of the same. This is not training.

His philosophy seems to indicate that it is an unfortunate but necessary homicide and the industry should all suffer together with it. I hope he will think it over from a long range viewpoint as they may give him that choice check pilots chore with his neck out every ride, or he might get a check pilot that is obsessed about this point. It could be his own ash burning instead of enjoying old age.

C. R. RUSHINGS, pilot
Zurich, Switzerland

From the Laboratories Famed for Precision Compasses

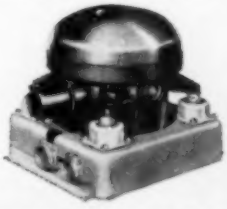
THE NEW C-10 GYROSYN*

. . . a Complete "World-Wide" Compass System Meeting Advanced Specifications for Polar Flight—**Yet Weighing Only 20 Pounds!**

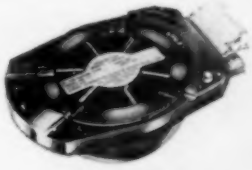
MASTER INDICATOR
Approx. weight 4¼ lbs.
Cut-out Dia. 3⅛ inches
Clearance behind panel 10⅛ inches

CONTROLLER
Approx. weight 1 lb
Height 2⁴¹⁄₆₄ inches
Length 5¾ inches
Clearance behind panel 3¹⁵⁄₁₆ inches

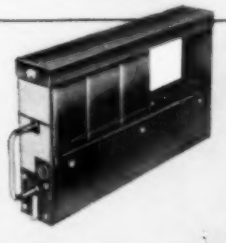
FLUX VALVE
Approx. weight 1½ lbs.
Width 3½ inches
Height 7½ inches
Length 4²⁹⁄₃₂ inches



FLUX VALVE
Approx. weight 1½ lbs.
Width 3½ inches
Height 2³¹⁄₆₄ inches
Length 4²⁹⁄₃₂ inches



RACK ASSEMBLY
Approx. weight 5 lbs.
¼ ATR
12¾ inches long



For more than a decade, Gyrosyn compasses by Sperry have set the standards of the aviation industry for commercial and military aircraft alike. Every day, hundreds of thousands of precision, on-course miles are flown with the aid of these accurate and dependable instruments. Yet in the Sperry laboratories the search for even greater accuracy and precision never ends—as evidenced by Sperry's most recent development, the C-10 Gyrosyn.

THIS IS PRECISION

At latitudes under 65° where the C-10 Gyrosyn is "slaved" to magnetic headings, accuracy is assured within ¾ of a degree. At latitudes above 65°, where magnetic headings are unreliable and the C-10 Gyrosyn is unslaved, random drift is less than 3° per hour. This compares with an average random drift of 8° to 16° per hour with many slaved compasses in use today.

THIS IS EFFICIENCY

A separate latitude corrector also automatically compensates for earth rate drift of the gyro, whether slaved or unslaved. Reliability of the system is further assured through the direct-drive nature of the master indicator which precludes transmission errors common to repeater-type instruments.

THIS IS THE ANSWER

. . . for today's faster-flying conventional aircraft and for tomorrow's turbo-prop and jet airliners. The C-10 Gyrosyn is recommended as the directional component of the SP-30 Flight Control System and the Integrated Instrument System, both of which are standard in the Douglas DC-8. It can be applied readily to modernize flight instrument equipment in existing aircraft. For complete information on the Sperry C-10 Gyrosyn, as well as other developments in the field of precision instrumentation, write our . . .

SPERRY *Aeronautical Equipment Division*
GYROSCOPE COMPANY
Great Neck, New York
DIVISION OF SPERRY RAND CORPORATION

CLEVELAND · NEW ORLEANS · LOS ANGELES · SAN FRANCISCO · SEATTLE. IN CANADA: SPERRY GYROSCOPE COMPANY OF CANADA, LIMITED, MONTREAL, QUEBEC

*T. M. Reg. U. S. Pat. Off.

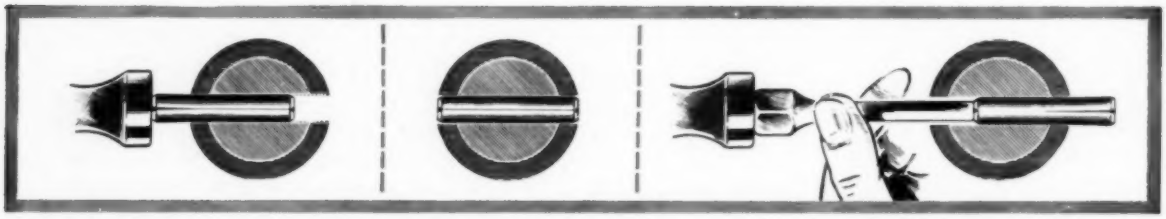
E B POWER GS
UNIVERSITY MICROFILM INC
313 N 1ST ST
ANN ARBOR MICH

...a. makes this fastener DIFFERENT?

Several things. Rollpin® is a slotted, chamfered, cylindrical spring pin which drives easily into a hole drilled to normal production standards. It locks securely in place, yet can be drifted out and reused whenever necessary. This eliminates special machining, tapping, and the need for hole reaming or precision tolerances. Rollpin replaces taper pins, straight pins and set screws; for many applications it will serve as a rivet, dowel, hinge pin, cotter pin or stop pin.

And here's another difference that makes Rollpin the quality fastener in the field: ESNA's quality control builds consistent strength and performance into every Rollpin. Rollpin is uniform as to shear strength, dimensions, hardness, and insertion and removal forces.

HOW YOU INSERT IT



Drives easily by hammer, arbor press, or air cylinder and can be readily adapted to an automatic hopper feed. Requires only a standard hole, drilled to normal production-line tolerances.

Locks securely in place without using a secondary locking device; won't loosen despite impact loading, stress reversals, or severe vibration.

Removes readily with a drift pin without damage to pin or hole, can be used again and again in original hole.

HOW YOU SAVE

You pay less for Rollpins than for most tapered, notched, grooved or dowel pins. Installation costs are substantially less than for any fastener requiring a precision fit or secondary locking operations.

Because of their tubular shape, Rollpins are lighter than solid pins. Production maintenance is reduced with Rollpins: they do not loosen and because of their spring action they tend to conform to the drilled hole in which they're inserted, without material hole wear, eliminating the necessity of re-drilling or using oversize pins.

MATERIALS AND SIZES

Standard Rollpins are made from carbon steel and Type 420 corrosion resistant steel. They're also available in beryllium copper for applications requiring exceptional resistance to corrosive attack, good electrical, anti-magnetic, and non-sparking properties. Stock sizes range from .062" to .500" in carbon and stainless steels.

ROLLPIN®

ESNA

ELASTIC STOP NUT CORPORATION OF AMERICA

Dept. R40-825, 2330 Vauxhall Road, Union, New Jersey

Please send me the following free fastening information:

- ☐ Rollpin Bulletin
- ☐ Elastic Stop nut Bulletin
- ☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name _____ Title _____

Firm _____

Street _____

City _____ Zone _____ State _____